# A Secure and Scalable Internet Routing Architecture (SIRA)


Vamsi Kambhampati | Colorado State University | vamsi@cs.colostate.edu
Beichuan Zhang | University of Arizona | bzhang@cs.arizona.edu
Lan Wang | University of Memphis | lanwang@memphis.edu
Daniel Massey | Colorado State University | massey@cs.colostate.edu
Ricardo Oliveira, Lixia Zhang | UCLA | {rveloso,lixia}@cs.ucla.edu
Dan Pei | AT&T Research | peidan@research.att.com


## 1 Motivation

- *Customer Networks*, who act as source or sink for data packets, **behave differently and have different needs** from *Provider Networks*, whose primary role is to provide data transit service for customers.
- Customers and providers have different vulnerabilities and advantages with respect to scalability, security and traffic engineering.
- These problems may be simplified if customers and providers are de-coupled into ***separate routing***, ***forwarding*** and ***address*** spaces
  - Customers have routes to only local subnets, direct providers, and directly connected customers.
  - Providers have routes to only other providers and directly connected customers.
  - Packets originating from customers cannot be addressed to provider devices.

## 2 Routing Problems Addressed by SIRA

### Routing Infrastructure Security

- Customer systems can directly address core routers.
  - Thousands of low security end systems can target core routers (a.k.a., botnet attacks).
  - Besides, end systems have no reason to contact core routers!
- Customer networks directly influence routing in the core.
  - Malicious prefix hijacking attacks.
  - Mis-configuration errors.

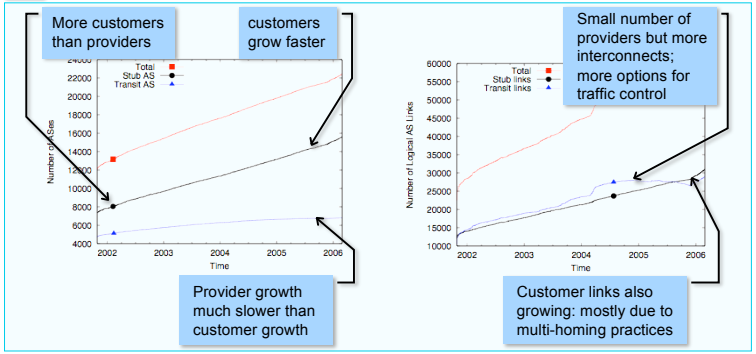
### Routing Scalability

- Customer networks and provider networks scale differently.
  - Providers grow slowly compared to customers.
  - Traffic engineering and multi-homing practices further increases customer growth.
- Local routing changes propagate globally.
  - A flap at customer network triggers several routing updates in the core.

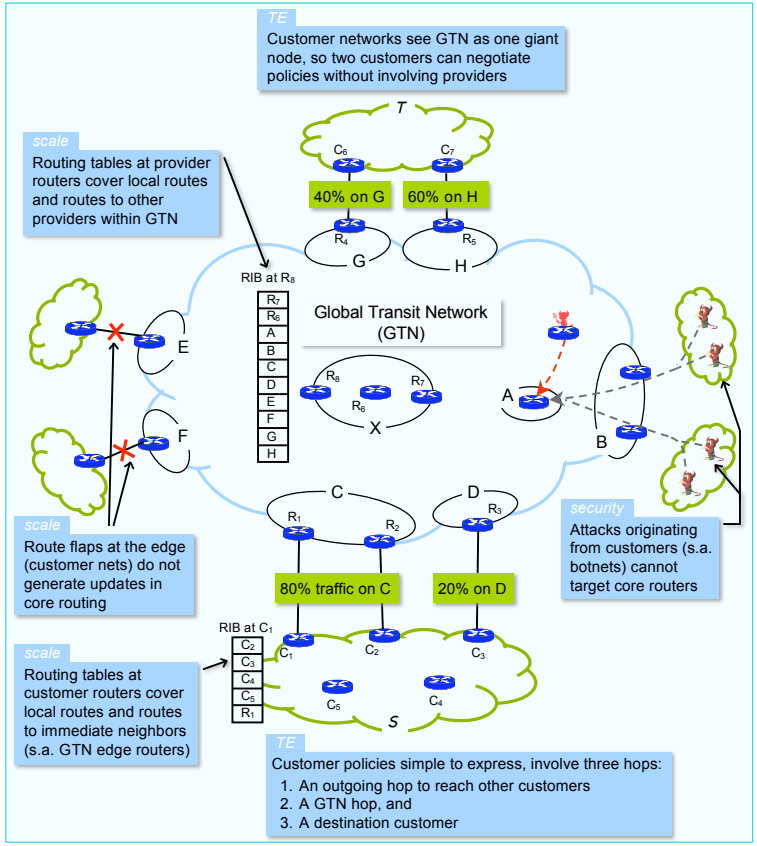
### Traffic Engineering

- Multi-homed customers would like to control how traffic enters and leaves the their network.
- Providers have traffic engineering requirements and may be better suited to make routing decisions.
- Current network is a compromise between provider and customer objectives, resulting in conflicts and complexity.

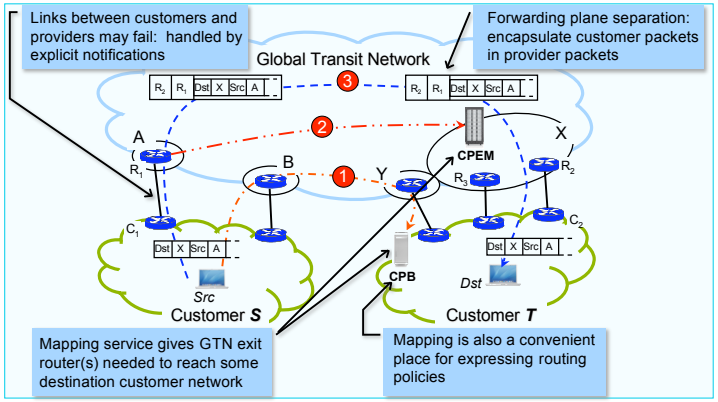
## 3 Separating Customers from Providers




## Why Separate?




## How SIRA Separates Customers and Providers

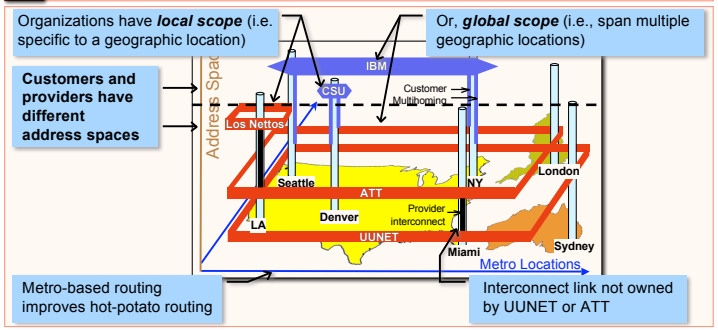



## Challenges for Mapping and Border Links

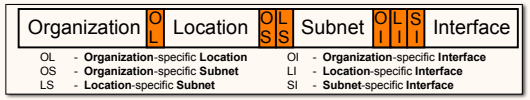
- Security of mapping service.
- Hierarchy (s.a. DNS) or DHT-based?
- How to express routing policies?
- Performance improvements: caching, pre-fetching?

- Links between CN and PN may change state (up/down, congestion etc)
- How to convey this to sender?
- Ex: Link between R2, C2 may be down
  - Need to tell *Src*

## 4 A Possible New Address Structure




## SIRA Address Structure Inspired by Previous Proposals





1. Steve Deering. Metro-based Addressing: A Proposed Addressing Scheme for IPv6 Internet. Presentation, Xerox PARC, July 1995.
2. Steve Deering. The Map & Encap Scheme for Scalable IPv4 Routing with Portable Site Prefixes. Presentation, Xerox PARC, March 1996.
3. Mike O'Dell. GSE - An Alternate Addressing Architecture for IPv6. draft-ietf-ipngwg-gseaddr-00.txt, February 1997.