Semantic Addressing and Routing Impact on Future Networks

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What Do I Mean by "Semantic Addressing"?

- It's important to set out the definitions of what we're talking about
  - There are currently no definitive references for some key terms
- Semantic addressing
  - Take a regular address (specifically IPv6)
  - Assign special meaning to some or all of the bits
  - What is "special"?
    - Anything beyond "identifies an interface on a device"
  - Examples
    - Multicast addresses
    - Segment Routing segment identifiers
    - Segment routing network programming instructions
- Are semantic addresses still routable?
  - Yes, but…
  - Some are simply routable and can be aggregated
  - Some are made routable via different routing protocols
  - Some may require special isolation from the Internet

What Do I Mean by "Semantic Routing"?

- Another definition that doesn't have a normative reference
- Semantic routing
  - Make routing decisions based on semantic addresses
    - So what? The addresses are routable anyway.
  - Make routing decisions that diverge from SPF
    - Based on the settings of some of the bits in an address
    - Based on other fields in the packet
  - Examples
    - ECMP and WECMP
    - IP Flex-algo

Setting Scope

- We talk a lot about "Limited Domains"
- There has been some work to define this (see RFC 8799)
  - But it is still a bit wishy-washy
- It is often suggested that semantic addressing can be deployed in a limited domain
- Walled gardens are fine for some applications
  - They have limited interaction with the outside world
    - Over tunnels to other limited domains
    - Through a server
    - Through a protocol gateway
    - By being bilingual
- But the Internet has to be fearful of pollution
  - What if a device is connected direct to the Internet?
  - What if a packet "escapes"?
  - What if two different semantic addressing schemes meet?
  - What if different devices have different semantic routing schemes?

The Challenge of Innovation

- What comes first: the technology or the use case?
- In engineering we are driven by immediate requirements
  - There is a problem in the network and we need to solve it
- In research we have creative ideas and investigate possibilities
  - There doesn't need to be a practical application driving the work, we look for uses later
- Semantic addressing and routing are being held up as supporting many potential new applications
  - Is this a solution in search of a problem?
  - Or are the problems pressing on us today?
- Whose job is it to step back and look at the risks?
  - Scalability
  - Stability
  - Interoperability
- We have an opportunity
  - To develop something new and interesting
  - To take the time to get it right

Enabling New Function

- The list is endless!
- Here are some ideas taken from draft-king-irtf-semantic-routing-survey
  - Device mobility in wireless networks
  - Optimized multicast
  - Device type identification
  - Content-based routing (CBR)
  - Physical layer connectivity identification
  - Hierarchical connectivity
  - Geographic location information
  - Service function chanining
  - Packet handling, prioritization, and resource usage
  - Cryptographic identity masking

What Questions Should Research Address?

- We have started to capture these in draft-king-irtf-challenges-in-routing
- We welcome open discussion on sarah@jiscmail.ac.uk
  - Semantic Address Routing and Hardware – SARAH
  - Sign-up at www.jiscmail.ac.uk/SARAH
- Questions identified so far
  1. What is the scope of the semantic address proposal?
  2. What will be the impact on existing routing systems?
  3. What path characteristics are needed for the routed paths?
  4. Can we solve these routing challenges with existing routing tools and methods?
  5. What is the scalability impact for routing systems?
  6. To what extent can multicast be developed?
  7. What aspects need to be standardised?