Semantic Routing

Requesting Your Help
draft-king-irtf-challenges-in-routing

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What are we trying to do?

• We’re trying to understand the implications for the routing subsystem of “Semantic Routing”

• We do this by:
  • Cataloguing existing proposals
  • Cataloguing existing research projects
  • Formulating a set of research questions

• We are not trying to:
  • Say whether any semantic routing proposal is good or bad
  • Come up with any routing protocol solutions

• But, what on earth do you mean by “Semantic Routing”? 
Routing on Additional Information

• Pre-history
  • Packets have a destination IP address
  • Routing finds the least cost path to the destination

• Routing has considered other information from the packet
  • DSCP
  • ECMP hashing on 5-tuple
  • IPv6 Flow Label
  • IPv6 Extension Headers
  • Etc.

• ... “Preferential Routing”, “Policy-based Routing”, “Flow steering”
Semantic Addressing

• Encoding additional information into an IP address
  • That is, giving enhanced meaning to the bits of an IP address

• There may be a scope of applicability
  • The semantics might be used only within a domain

• To some extent we have done this already by assigning prefixes
  • Documentation addresses
  • Loopback addresses
  • Multicast address space
  • Private use addresses
  • IPv4-IPv6 encoding
  • Etc.

• But is that it?
More Recent Semantic Address Proposals

1. Address things other than interfaces
   - For example, address network functions or end-point-processing
     - Such as SRv6 Network Programming (RFC 8986)
     - Direct addressing in SFC
     - Hybrid ICN (hICN)

2. Shorter (variable/flexible) addresses
   - Useful for constrained environments?
     - IoT
     - SRv6 SID stacks

3. Hierarchically scoped addresses
   - Scaling the global address table
   - Tying geolocation to IP addresses
   - Making “simpler” multi-domain routing

4. Encode additional information in some of the bits of an address
   - See draft-jiang-semantic-prefix for a survey
Semantic Routing – What Is It?

• Simply put...
  Routing on addresses that contain additional semantics
• Legacy nodes may need to “survive” semantic addressing
• New or enhanced nodes may be get additional routing function from semantic addresses
Routing Research Questions for Semantic Addressing (WIP)

1. What is the scope of the semantic address proposal?
   • Global, backbone, overlay, domain, domain with gateway, ...

2. What is the impact on the existing routing system?
   • Do protocols have to change? What happens if semantic addresses “escape”?

3. What path characteristics are mapped from the addresses?
   • What info does the network need to collect? How is it distributed?

4. Do we need new software and hardware?
   • What are the optimisation versus generalisation tradeoffs?

5. How does it scale?
   • Performance (convergence, on-wire), memory (routing table, other state)

6. Is multicast supported?

7. What needs to be standardised?
   • Why?
What Do We Want from You?

• Pointers to relevant work
  • Proposals for Semantic Addressing
  • Research into Semantic Routing

• Suggestions for additional research questions
  • Some initial thoughts
    • draft-jia-intarea-scenarios-problems-addressing
    • draft-king-irtf-challenges-in-routing
  • What could go wrong with routing?
  • What routing problems should people be researching?
  • What type of networks should people experiment with?

• Where to discuss this?
  • Obviously, you can email the authors direct
  • Mainly it’s research work so irtf-discuss@ietf.org is appropriate
  • Possibly the ADs won’t mind if we continue on routing-discussion@ietf.org