Efficient In-band Service Announcement Through IPv6 Address Encoding

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4th German IPv6 Summit – Hasso-Plattner-Institute, Potsdam – December 1st, 2011
Idea – Encoding Service Information

How to find services in a network?
→ today: dedicated service announcement/discovery mechanisms

→ implicit solution?

Idea: Encode service information into IPv6 addresses

encode services offered by system into its own IPv6 address
infer information about provided services from IPv6 address
lots of traffic to listen to → collect service information!
Encoding Schemes

- How to encode this information?
  - 62 bits of IPv6 address can be used for encoding services

- Bitwise Encoding
  - predefined bit for every service
    - pro: simple
    - con: fixed maximum number of services, service definition must be possible, requires homogeneous network (encoding performed by all systems)
**Encoding Schemes**

- **Bloom Filter Encoding**
  - probabilistic data structure that allows insert and query operations through multiple hash functions, no false negatives, false positives

- **pro**: number of services potentially huge and dynamically extensible
- **con**: false positives, limited number of concurrently encoded services
  - encoding of max ~10 services possible in one IPv6 address with 5% false positive probability
Applicability and Use Cases

- **Pro-active service caching in LANs**
  - system can learn about available services “on-the-fly”
  - restrict service decoding to LAN segment or authorized systems
    - use MAC address or secret key to seed the Bloom filter

- **Sensor network service discovery**
  - strong resource constraints
  - overhead through dedicated discovery protocols

- **Peer-sampling in overlay networks**
  - encode useful information to improve peer sampling
Conclusion and Open Issues

- **Systematic use of free bits in IPv6 addresses**
  - no additional traffic $\rightarrow$ inband
  - support existing service announcement/discovery mechanisms
  - two exemplary encoding schemes: bitwise, Bloom filter based

- **Open Issues**
  - handling identical service sets on different systems
    - e.g. encode system’s MAC address into Bloom filter
  - handling Bloom filter false positives
    - e.g. hash a service indicating magic number into interface ID
  - proof of concept implementation
Thank you for your attention! Questions?

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