IETF Routing Area Update

A Report after IETF 96 (Berlin)

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No one is in charge, anyone can contribute and everyone can benefit.

IETF Organization: Areas

General Area (gen)	• ...activities focused on supporting, updating and maintaining the IETF standards development process.
Security (sec)	• ...focused on security protocols...services: integrity, authentication, non-repudiation, confidentiality, and access control...key management is also vital.
Applications and Real Time (art)	•Protocols for delay-sensitive communications, and building blocks to be used across a wide variety of applications.
Operations & Management (ops)	• Network Management, AAA, and various operational issues facing the Internet such as DNS, IPv6, operational security and Routing operations.
Transport Services (tsv)	• ...works on mechanisms related to end-to-end data transport...
Routing (rtg)	• ...responsible for ensuring continuous operation of the Internet routing system...
Internet (int)	• ...IP layer (both IPv4 and IPv6), DNS, mobility, VPNs and pseudowires..., and various link layer technologies.

IETF Meetings

Recent Meetings

- **IETF 94**
  - November 1-6, 2015
  - Yokohama, Japan
- **IETF 95**
  - April 3-8, 2016
  - Buenos Aires, Argentina
- **IETF 96**
  - July 17-22, 2016
  - Berlin, Germany

Upcoming Meetings

- **IETF 97**
  - November 13-18, 2016
  - Seoul, South Korea
- **IETF 98**
  - March 26-31, 2017
  - Chicago, IL, USA
- IETF 99
  - July 16-21, 2017
  - Prague, Czech Republic

Hot Topics at IETF 96

- Infrastructure Resiliency and Security
  - DNS and Routing
- Scalability and Performance
- IPv6
- YANG Modeling
- IoT
- Trust, Identity, and Privacy

Meeting Venue Selection

mtgvenue (Monday 1540)

imtg (Tuesday 1000)

http://www.internetsociety.org/rough-guide-ietf95

Routing Area (RTG)

- “...responsible for ensuring continuous operation of the Internet routing system by maintaining the scalability and stability characteristics of the existing routing protocols, as well as developing new protocols, extensions, and bug fixes in a timely manner.”

- 25 WGs
- 3 Area Directors

https://datatracker.ietf.org/wg/#rtg

Routing Area (rtg)

- Babel Routing Protocol (babel)
- BGP Enabled Services (bess)
- Bidirectional Forwarding Detection (bfd)
- Bit Indexed Explicit Replication (bier)
- Common Control and Measurement Plane (ccamp)
- Deterministic Networking (detnet)
- Interface to the Routing System (i2rs)
- Inter-Domain Routing (idr)
- IS-IS for IP Internets (isis)
- Layer Two Tunneling Protocol Extensions (l2tpext)
- Locator/ID Separation Protocol (lisp)
- Mobile Ad-hoc Networks (manet)
- Multiprotocol Label Switching (mpls)
- Network Virtualization Overlays (nvo3)
- Open Shortest Path First IGP (ospf)
- Pseudowire And LDP-enabled Services (pals)
- Path Computation Element (pce)
- Protocol Independent Multicast (pim)
- Routing Over Low power and Lossy networks (roll)
- Routing Area Working Group (rtgwg)
- Service Function Chaining (sfc)
- Secure Inter-Domain Routing (sidr)
- Source Packet Routing in Networking (spring)
- Traffic Engineering Architecture and Signaling (teas)
- Transparent Interconnection of Lots of Links (trill)

Open Source Routing Projects

- Open Standards and Open Source are Complementary

- Routing Area Open Source Coordination
  - https://www.ietf.org/mailman/listinfo/rtg-open-source
  - https://trac.tools.ietf.org/area/rtg/trac/wiki/RtgOpenSrcCoord

- Contribute by sharing the RTG-related Open Source work you are involved in!

RTG YANG Model Development

- Area and IETF-wide Coordination
  - High Level of Operator Participation
  - Opportunity to Shape and Improve Common Device Configuration
- Challenges: device differences, full models needed, common abstraction and functionality

- RTG YANG Coordination Forum: https://trac.tools.ietf.org/area/rtg/trac/wiki/RtgYangCoord
- RTG YANG Architecture DT: https://trac.tools.ietf.org/area/rtg/trac/wiki/RtgYangArchDT
  - Repo: https://github.com/ietf-rtg-area-yang-arch-dt/

- Which RTG Models should be prioritized?

Routing Area (rtg) – IP Routing

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SIDR Operations (sidrops) (Proposed WG)

The SIDR Operations Working Group (sidrops) develops **guidelines for the operation of SIDR-aware networks**, and provides operational guidance on how to deploy and operate SIDR technologies in existing and new networks.

The main focuses of the SIDR Operations Working Group are to:

o **Discuss deployment and operational issues** related to SIDR technologies in networks which are part of the global routing system.

o **Gather and discuss deployment experiences** with the SIDR technologies in networks which are part of the global routing system, as well as the repositories and CA systems that also form part of the SIDR architecture

BABEL WG Charter

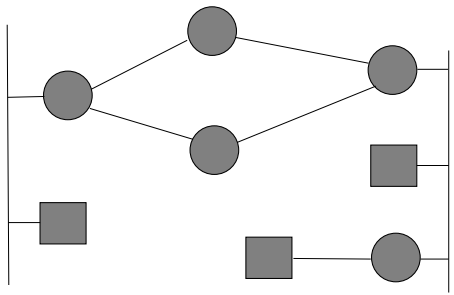
- The Working Group will focus on moving the Babel protocol to IETF Proposed Standard with IETF review…It is not a requirement that the Babel protocol produced is backwards compatible with RFC 6126. It is a requirement that Babel support at least one profile that is auto-configuring…Particular emphasis will be placed on…ensuring manageability and strong security.

https://datatracker.ietf.org/wg/babel/charter/

Hybrid networks

Successful deployment 1/4

Babel works well in classical, prefix based networks (supports aggregation, filtering, etc.).
Babel works well in pure mesh networks (non-transitive and unstable links).

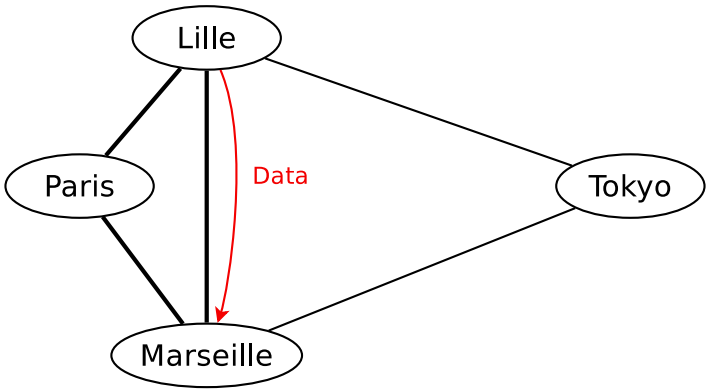


Babel works well in hybrid networks, networks with prefix based parts interconnected through meshy bits.

Global-scale overlay networks

Successful deployment 2/4

The RTT-based routing extension enables non-pessimal routing in global-scale overlay networks:



RTT-based routing may cause persistent oscillations, but Babel remains robust even in the presence of oscillations.

Source-specific routing

Successful deployment 3/4

The source-specific extension to Babel gives:

- full support for source-specific routing (SADR);
- interoperability with plain, unextended Babel.

Babel is useful wherever source-specific routing is needed.

Small, simple networks

Successful deployment 4/4

Babel is a small, simple protocol and requires no configuration in simple cases.

It is often used in trivial networks: a useful RIP replacement.

Pure mesh networks

Potential deployment 1/1

Babel has been repeatedly shown to be competitive with dedicated mesh routing protocols:

- better on some tests;
- worse on others.

However, standardised, well implemented protocols for mesh networks exist:

- OLSR-ETX;
- OLSRv2 with the DAT metric;
- . . .

This particular niche is already populated.

Large, stable networks

Non-recommended deployment 1/1

There exist protocols that are finely tuned for large, wired networks:

- OSPF;
- IS-IS;
- EIGRP.

Babel relies on periodic route announcements, and will never be competitive with protocols that only send deltas.

Routing Area (rtg) – MPLS

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Routing Area (rtg) – SDN/Overlays

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nvo3 – Multiple Encapsulations

- Why are multiple encapsulations needed?
  - Metadata, flexibility, hardware considerations, middlebox avoidance, transport considerations or independence, isolated ecosystems, etc.
- Encapsulation Considerations: hardware cost, ECMP, Packet Size & fragmentation/reassembly, OAM, Security & Privacy, Congestion Considerations, QoS / CoS, Extensibility, Layering of multiple Encapsulations

- In nvo3… Consideration around VXLAN-GPE, GENEVE, and GUE.
- How should the WG proceed?

Routing Area (rtg) – Mobility/IoT

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Routing Area (rtg) – Other

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Enterprise Multihoming using Provider-Assigned Addresses without Network Prefix Translation: Requirements and Solution

Draft-bowbakova-rtgwg-enterprise-pa-multihoming-00

F. Baker, C. Bowers, J. Linkova

IETF96, Berlin, July 2016

Problems with PA Multihoming

Q: How to send packets to the correct uplink (BCP38)?

Q: How to implement policies?

Q: How to react to links failure/recovery?

WITHOUT NAT!

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https://www.ietf.org/proceedings/96/slides/slides-96-rtgwg-0.pdf

Solutions with PA Multihoming

Q: How to send packets to the correct uplink (BCP38)?

A: Source Address Dependent Routing (SADR)

NO NAT!

Q: How to implement policies?

Q: How to react to link failure and recovery?

A: Influence source address & next-hop selection on hosts

https://www.ietf.org/proceedings/96/slides/slides-96-rtgwg-0.pdf

Requirements/Expectations

Hosts have addresses from 2 or more non-overlapping blocks

Packets are sent to an ISP only if src address belongs to PA space of that ISP

"No uplink for this source" is signalled to hosts

Hosts are expected to properly select a source address

Different DA might require different sources

Intra-site communication is not affected

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Summary: Network

- SADR allows network to send packets to the "right" egress point
- SADR can be deployed incrementally
- MUST be enabled on the edge
- Enabling on first-hop routers helps to control address selection on hosts

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https://www.ietf.org/proceedings/96/slides/slides-96-rtgwg-0.pdf

Summary: Source Address Selection on Hosts

- SADR-capable routers sending scoped RAs allow hosts to select the correct source address
- No changes in hosts behaviour are required for hosts supporting *(some testing required)*:
  - RFC4191 (Default Router Preferences and More-Specific Routes)
  - Rule 5.5 of Source Address Selection Algorithm
- If local connectivity is required when all uplinks are down: use ULAs
- ICMPv6 could be used to signal errors

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First-hop router selection by hosts in a multi-prefix network
(draft-ietf-6man-multi-homed-host-09)
https://www.ietf.org/proceedings/96/slides/slides-96-rtgwg-0.pdf

Summary

- Routing Protocols are mature and stable, but are also entering a new era of increased, dynamic coverage.
  - Convergence, Availability, Scalability and Security are still front and center...
- More than 200 routing-related work items are being considered in the Routing Area (and beyond)
  - New requirements are coming from a diverse set of sources: from the Internet of Things, traditional SP and Enterprise networks, to SDN and beyond.

Get Involved!

TOMORROW starts here.