

# IETF Routing and Addressing Activities Update

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# Disclaimer

- This presentation is not an official IETF report
  - Believed to be accurate
  - Purpose: raise awareness
- Based on material from subject matter experts
  - Errors: blame me

# The IAB R&A workshop

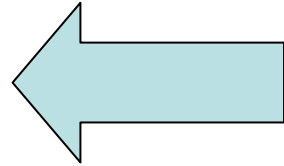
- BGP4 used since 1994 with little change
- Mounting concern at growth in routing table
  - size & update rate, impact of multihoming
  - largely orthogonal to IPv4 v IPv6
- IAB Routing & Addressing workshop 10/06
  - concluded that there is a problem, but more work needed to define it
  - see draft-iab-raws-report
- Multiple discussions since then, sometimes confused and confusing
- Need to clarify what we know, what we don't know, and how to proceed systematically

# Recent Activity in the IETF, IRTF, IAB

- Refining the IAB workshop report
- Analyzing the concerns it raised
- Looking at solutions
- R&A Directorate established
  - role is coordination and communication
- Routing Research Group recharter
- R&A discussion list active (ram@iab.org)

# Prague IETF

- Plenary presentation on overall activities
- Full day Routing Research Group (RRG) workshop
  - Including next steps and charter
- Internet Area
  - BOF-style discussion on identifier-locator separation issues and future directions
  - Clear interest in doing work, but scope uncertain
- Routing Area
  - Routing table growth and routing dynamics
  - BGP extensions/practices that might help



# Context: What problems to solve

- Historic concerns about scaling, transparency, multihoming, renumbering, provider independence, traffic engineering, IPv6 impact (1995-2006)
- Solve end user problems
  - Connect to multiple ISPs with failover and load balancing
  - Change ISPs without major switching costs
  - Support e2e session transparency, ...
- Solve ISP problems
  - Keep routing table size and dynamics within router operational capability
  - Provide ISPs with ability to engineer traffic flows to match business needs

# More Context Architecture

- A network should be able to implement reasonable internetworking choices without unduly impacting another network's operation
- We are breaking this principle in today's routing system, and this is the root cause of the ISP problems

# Even more Context: Scale

- Today, 200k Internet eBGP routes and several times *more* customer VPN (iBGP) routes is common
- A goal for 2050 is  $10^{12}$  end nodes with 10 million multihomed customers
- Can we get there from here at reasonable costs for vendors, ISPs and user sites?
- What should be the 5 year goal? 1 million Internet routes?



# Is there a "hot box" problem?

- It was asserted in the workshop that hardware trends prevent continued scaling of the FIB (Forwarding Information Base)
  - if true, it means the FIB must scale sub-linearly with the number of end sites, breaking current multihoming and PI practice
- Recent analysis indicates that for at least for two more generations of microelectronics (45nm, 32nm) this isn't a problem - neither RIB\* nor FIB size dominates core router power or real estate.
  - looks like 5 to 10 years of growth
  - In fact, core router scaling seems to be dominated by line speed multiplied by functional complexity (in the forwarding path).
- *No need for panic*
- *But improvements wrt architectural principle useful*

# Is there a "hot wire" problem?

- It's been said that even if we contain the RIB size, BGP4 dynamics (update messages) will saturate... something.
- There is experimental evidence of a lot of update traffic that is potentially redundant (i.e. wasting a lot of energy on transient connectivity glitches)
  - but we seem to have no analytical model for the impact of this as the network continues to scale
  - if problematic, it means the update rate has to scale sub-linearly with the number of end sites
- *This problem needs continued investigation*  
(Possibly within the context of the GROW-WG)

# The transparency problem

- Since 1981, upper layers have assumed that a *Thing That Looks Like An Address* **is** an address.
  - Application programmers often assume that an IP address is a valid end system identifier that can also be passed on to third parties
- In consequence, the fact that addresses are sometimes merely locators is a problem (which NAT, STUN etc. deal with in their own ways)
- The historical reliance on address transparency creates specific difficulty for multihoming and traffic engineering
- *This problem seems to need a solution*

# Solution directions

- RIB/FIB scaling - engineering by microelectronics and router designers
- Update dynamics - BGP adjustments, better operational practices
- Traffic engineering, multihoming, e2e transparency, and mobility would benefit from architectural changes
  - identifier/locator separation and/or multilevel locators form a hopeful approach
  - Albeit not trivial: work may need to happen all the way up to the application layer
- All these are orthogonal to both IPv6 deployment and application level namespace issues

# Technical Summary

- Routing table growth is "only" an engineering issue
  - for at least one more generation of microelectronics
- Routing dynamics needs to be better understood, but is likely also an engineering issue
  - to be addressed by stronger pushback in the ISP community, implementation improvements, protocol improvements
- Thus, there is reason to believe we do not have a short term technology problem
  - But hard work and business issues are ahead.
- Loss of address transparency is an architectural problem
- IETF can help in short term protocol work
  - Such as tuning BGP better for today's challenges
- IETF can also help by looking at architectural changes
  - Such as identifier/locator separation & multi-level locators

# Overall Plan

Divide and conquer:

- Continue dialog with the operator community
- Pursue implementation improvements
- Evaluate incremental BGP improvements
- Encourage Id-Loc split and multilevel locator research and experimentation
- Define an IETF Id-Loc split or multilevel locator solution

# Where is the energy flowing

- Completion of problem statement (or statements), pulled by the directorate.
- Clarify where work is to be done in order to address the problem
  - in RRG (e.g., longer-term ID/Locator research work)
  - INT Area (e.g., existing shorter-term ID/locator engineering work)
  - in existing Routing Area WGs (e.g. in the IDR-WG)
  - In OPS area (e.g. BCP material to help reduce churn)

# participate

- There is protocol and operations work that needs to be done
- Progress only made through active participation



# Other IETF Activities to be aware off

- DNS and ENUM
  - Report in the DNS-WG and ENUM-WG
- OPSEC
  - Operational Security Capabilities for IP Network Infrastructure
  - <http://www.ietf.org/html.charters/opsec-charter.html>

The goal of the Operational Security Working Group is to codify knowledge gained through operational experience about feature sets that are needed to securely deploy and operate managed network elements providing transit services at the data link and IP layers.

# Questions?

# References

- December Message from IAB & IETF Chairs
  - <http://www1.ietf.org/mail-archive/web/ietf-announce/current/msg03255.html>
- Workshop report:
  - <http://tools.ietf.org/html/draft-iab-raws-report-02>
- RAM mailing list:
  - <https://www1.ietf.org/mailman/listinfo/ram>
- Routing Research Group:
  - <http://irtf.org/charter?gtype=rg&group=rrg>
- Plenary slides:
  - <http://www3.ietf.org/proceedings/07mar/slides/plenaryw-3.pdf>
- Other relevant material
  - [http://submission.apricot.net/chatter07/slides/future\\_of\\_routing/apia-future-routing-john-scudder.pdf](http://submission.apricot.net/chatter07/slides/future_of_routing/apia-future-routing-john-scudder.pdf)
  - <http://www.apricot2007.net/presentation/conference/plenary1-vince.pdf>
  - [http://submission.apricot.net/chatter07/slides/future\\_of\\_routing/apia-future-routing-jari-arkko.pdf](http://submission.apricot.net/chatter07/slides/future_of_routing/apia-future-routing-jari-arkko.pdf)
  - <http://www3.ietf.org/proceedings/07mar/>