# IETF 93 ROLL

## Routing over Low-Power And Lossy Networks

**Chairs:**

Michael Richardson

Ines Robles

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Source: https://www.ietf.org/about/note-well.html

# Meeting Materials

- Remote Participation

  - Jabber Room: roll@jabber.ietf.org

  - Meetecho: http://www.meetecho.com/ietf93/roll

- Etherpad:

  - http://tools.ietf.org/wg/roll/minutes

- Audio Streaming: https://congresshall1.conf.meetecho.

  com/meetecho/login.jsp?ietf=roll

- Minutes taker:

- Jabber Scribe:

- **Please sign blue sheets :-)**

# Agenda

- State of: (10  minutes)

    - Work item

    - ROLL I-D

    - Related I-D

    - Open Issues

- Liaison on concerns on the deprecation of dispatch type in 6loWPAN and its header compression mechanism to roll (10 min)
- draft-robles-roll-useofrplinfo-00 (18 min)

- draft-thubert-roll-dao-projection-00 (20 min)

- Open floor (2 minute)

# Milestones (cont.)

| Milestone | Schedule |
|---|---|
| Submit draft about when to use RFC 6553, RFC 6554, and IPv6-in-IPv6 encapsulation to the IESG. | Aug 2015 |
| Submit draft about how to compress RFC 6553, RFC 6554, and IP headers in the 6LoWPAN adaptation layer context to the IESG. | Nov 2015 |
| Evaluate WG progress, recharter or close | Nov 2015 |

# State of Active Internet-Drafts

| | |
|---|---|
| **draft-ietf-roll-admin-local-policy-03** | RFC Editor Queue |
| **draft-ietf-roll-applicability-ami-10** | Addressing Issues from LC |
| **draft-ietf-roll-applicability-home-building-12** | New Version - Issues from LC Addressed |
| **draft-ietf-roll-applicability-template-07** | Stable - not to be published |
| **draft-ietf-roll-trickle-mcast-12** | RFC Editor Queue |
| **draft-ietf-roll-mpl-parameter-configuration-06** | In IESG, Issues to be addressed from LC. |

# Related Internet-Drafts

| | | |
|---|---|---|
| draft-robles-roll-useofrplinfo-00 | Energy-awareness metrics global applicability guidelines | Slides Today |
| draft-thubert-roll-dao-projection-00 | Root initiated routing state in RPL | Slides Today |
| draft-tan-roll-clustering-00 | RPL-based Clustering Routing Protocol | Future Discussion |

# Open Tickets

| Ticket | Summary |
|--------|---------|
| | |
| #169 | Work Item Proposals |
| #170 | Use of ESC Dispatch value in new IETF header compression |
| #171 | Int-Dir review of draft-ietf-roll-mpl-parameter-configuration-06 |

# Liaison from ITU-T SG15 to ROLL and 6Lo

https://datatracker.ietf.org/liaison/1415/

ITU-T Study Group 15 has been designated as the lead study group for communications-related aspects of

Smart Grid. Question 15 (Q15/15) is

responsible for Recommendations ITU-T G.9903 (Narrow-band OFDM power line communication transceivers

for G3-PLC networks – approved in 02/2014) and ITU-T G.9905 (Centralized Metric based Source Routing –

approved in 07/2013).

These two Recommendations normatively reference 6loWPAN (RFC 4944) and its header compression

mechanism (RFC6282).

We would like to bring to your attention that on-going discussion in IETF 6lo and ROLL WGs on reusing the ESC

and MESH dispatch headers for route-over and mixed operations may lead IETF to deprecate the possibility of

using RFC4944 and/or RFC6282 in pure mesh-under networks. This deprecation would create a conflict with

Recommendation ITU-T G.9903 and possibly also other standards.

Details on how ITU-T G.9903 uses the ESC and MESH dispatch headers, confirming how important the stability of the 6LoWPAN standard and related IANA allocations are for ITU-T G.9903:
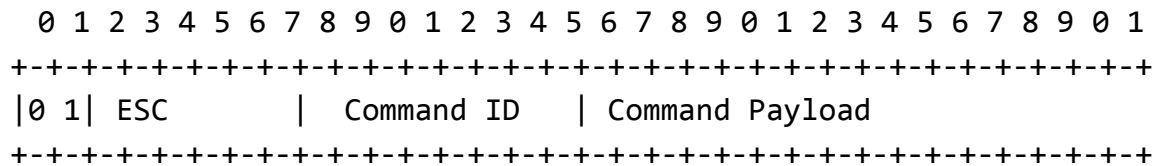
1.    ITU-T G.9903 provides native mesh-under functionalities (the LOADng protocol, which is described in Annex D) while not prohibiting the use of other mesh-under (e.g. CMSR specified in ITU-T G.9905) or route-over routing protocols. If other routing protocols are used, then the native mesh-under LOADng protocol can be disabled.

    a.    The first octet corresponds to the ESC Dispatch Header as specified in RFC 6282, i.e. 0b10 000 000.

    b.    The second octet corresponds to the command ID. As specified in Table 9-35/G.9903, three possible commands are currently specified (additional commands can be specified to support other routing protocols):

        i.    o LOADng command frame

        ii.    o loWPAN bootstrapping command frame

        iii.    o CMSR command frame (see ITU-T G.9905).

    c.    The rest of the frame carries the payload for the relevant command frame.

```
 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|0 1| ESC       | Command ID   | Command Payload
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

G.9903 Frame Format with ESC Byte  ( draft-chairs-6lo-dispatch-iana-registry-00 )

2.   The ESC Dispatch Header is used by ITU-T G.9903 exclusively for command frames. A command frame is built as follows (see Figure 9-12/ G.9903):

3.   During the bootstrapping phase, the 6LOWPAN_IPHC and ESC headers are present in the same frame. The ESC dispatch header is placed after the 6LOWPAN_IPHC header.

4.   The MESH Header as specified in RFC 4944 is used for data frames only and contains vital information for the correct delivery of G.9903 data frames when the mesh-under LOADng routing protocol is used.

As of today, Japan and France have already started deployment of ITU-T G.9903 smart meters (in France smart meters will represent a total of 32 million ITU-T G.9903 smart meters – 100% national coverage – by 2021). There are also deployed wireless technologies for smart metering (e.g., based on 802.15.4) that support layer 2 mesh routing as well. Furthermore, interest in such technologies transcends smart metering applications and includes a broader set of Smart Grid applications and beyond, making ITU-T G.9903 an important enabler also for IoT applications.

As several existing standards/products rely on using the Dispatch ESC Header for exchanging mesh-under routing and bootstrapping command messages, we would like to bring to your attention that deprecating this feature would have detrimental effects on Smart Grid plans of several countries and utilities:

• Planned deployments would have to be delayed until a viable alternative is found, standardized, and tested in the field. This would make several utilities in the world inevitably incur high costs.

• Future deployments based on the above alternative would be non-interoperable with the currently installed base of devices that rely on the availability of the Dispatch ESC Header.

• Any delay would put at risk complying with deadlines set by regulators of several countries. One notable example is the 2008 Directive from the European Union which mandates EU countries to deploy 80% of smart meters by 2020.

ITU encourages IETF to:

- <span style="color:red">Avoid deprecation of the ESC and MESH dispatch headers</span> and look for alternative solutions that do not create conflict with existing standards and products.

- Work in cooperation with Q15/15 to find alternate solutions that do not create conflicts with ITU-T Recommendations.

Q15/15 looks forward to continued cooperation with IETF.

# ROLL is going to work with 6Lo

- Answer to ITU-T about:


  - IETF will not make any changes which will adversely affect G.9903.


  - IETF will also collaborate with ITU-T SG15 to create an IANA registry for the codepoints used in G.9903.

Consensus?

# When to use RFC 6553, 6554 and IPv6-in-IPv6

## draft-robles-roll-useofrplinfo-00

Michael Richardson

Ines Robles

# Goal:

This document states different cases where RFC 6553, RFC 6554 and IPv6-in-IPv6 encapsulation is required to set the bases to help defining the compression of RPL routing information in LLN environments.

# Why we need?

RFC 6553: to transmit routing information using HBH (RPL Option) e.g. loop avoidance

RFC 6554: provides Source Routing Header (SRH) for use strictly between RPL routers

IP-in-IP: useful when we want to transmit a packet without modify it.

# Scenarios

-Flow from leaf to root

| | Storing | Non - Storing |
|---|---|---|
| RFC 6553 | - Is that possible, how?<br>- Packet example<br>- something else???? | |
| RFC 6554 | | |
| IPv6-in-IPv6 | | |

Internet

00  root

11          12

21          22

31    32          33

leaf

# Scenarios

-Flow from leaf to Internet

| | Storing | Non - Storing |
|---|---|---|
| RFC 6553 | - Is that possible, how? | |
| RFC 6554 | - Packet example | |
| IPv6-in-IPv6 | - something else???? | |

Internet

root

leaf

# **Scenarios**

-Flow from leaf to leaf

| | Storing | Non - Storing |
|---|---|---|
| RFC 6553 | - Is that possible, how? | |
| RFC 6554 | - Packet example | |
| IPv6-in-IPv6 | - something else???? | |



Internet

root

leaf

leaf

# Scenarios

Internet

-Flow from Internet to leaf

root

| | Storing | Non - Storing |
|---|---|---|
| RFC 6553 | - Is that possible, how? | |
| RFC 6554 | - Packet example | |
| IPv6-in-IPv6 | - something else???? | |

leaf

# Scenarios

-Flow from root  to leaf

| | Storing | Non - Storing |
|---|---|---|
| RFC 6553 | - Is that possible, how? <br> - Packet example <br> - something else???? | |
| RFC 6554 | | |
| IPv6-in-IPv6 | | |

Internet

root

leaf

**Are there additional scenarios which will have interesting requirements?**

**For each scenario, do we always need all of 6553, 6554 and IPIP?**

тнапкѕ!

# Root initiated routing state in RPL

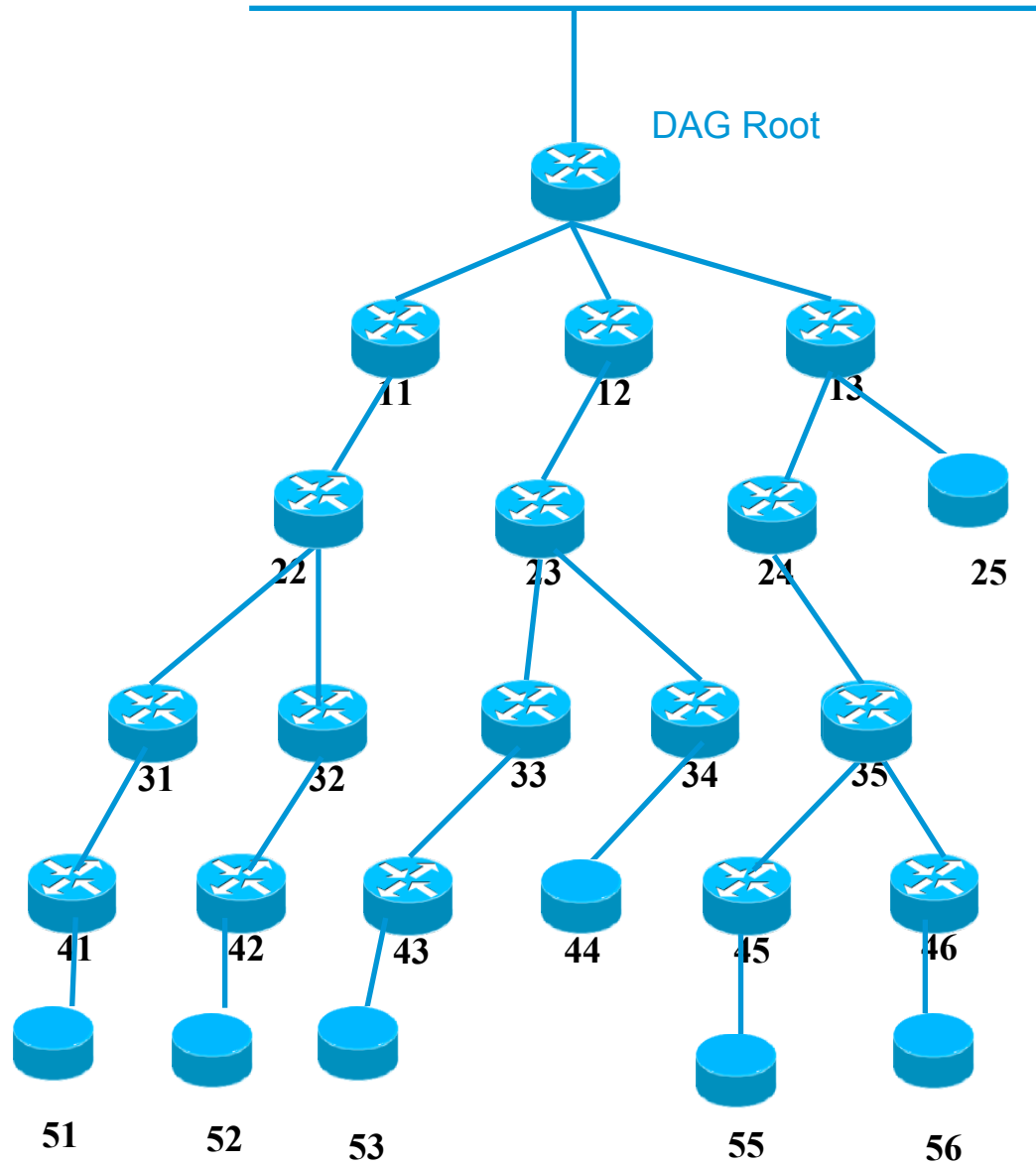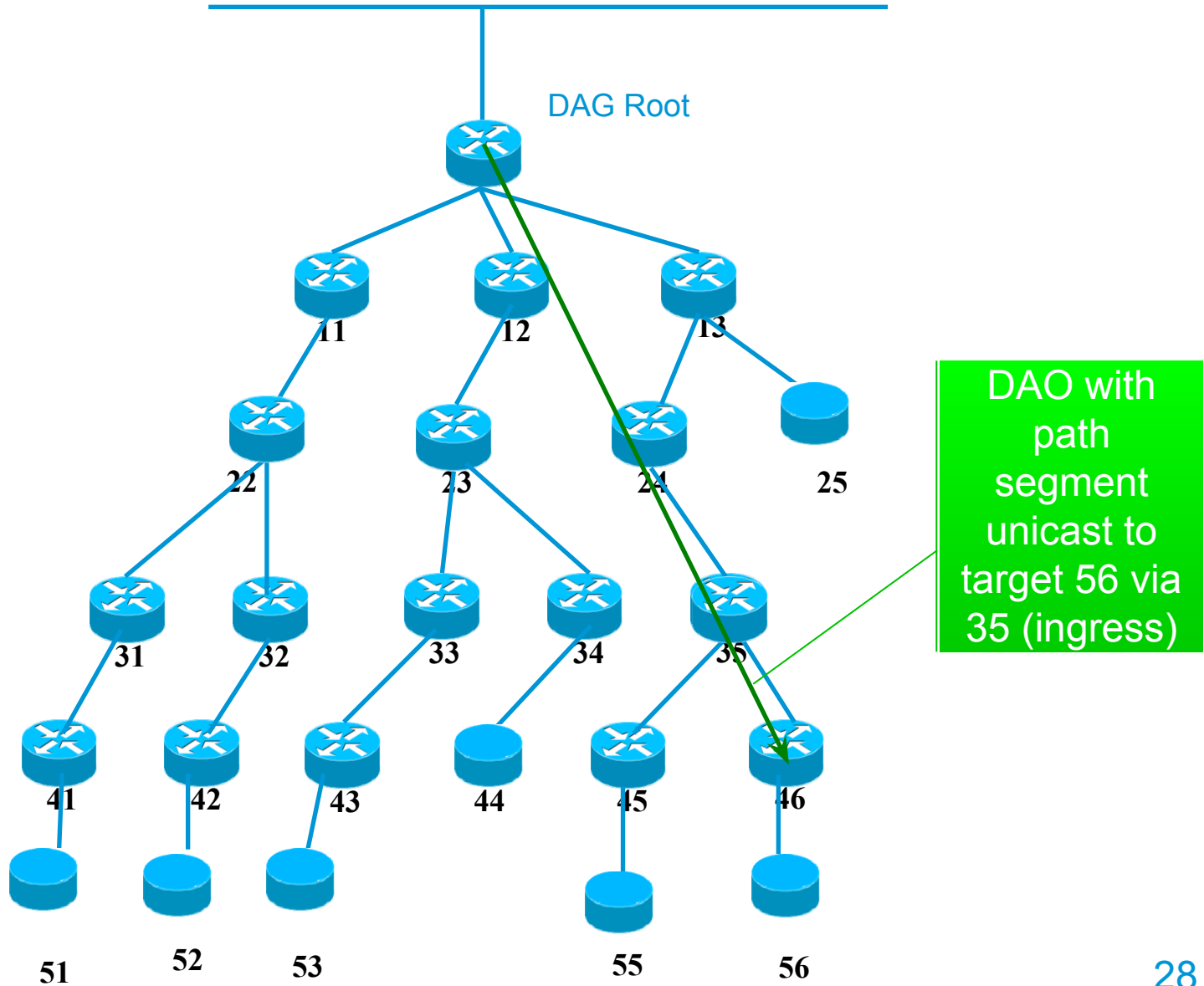[draft-thubert-dao-projection](draft-thubert-dao-projection)

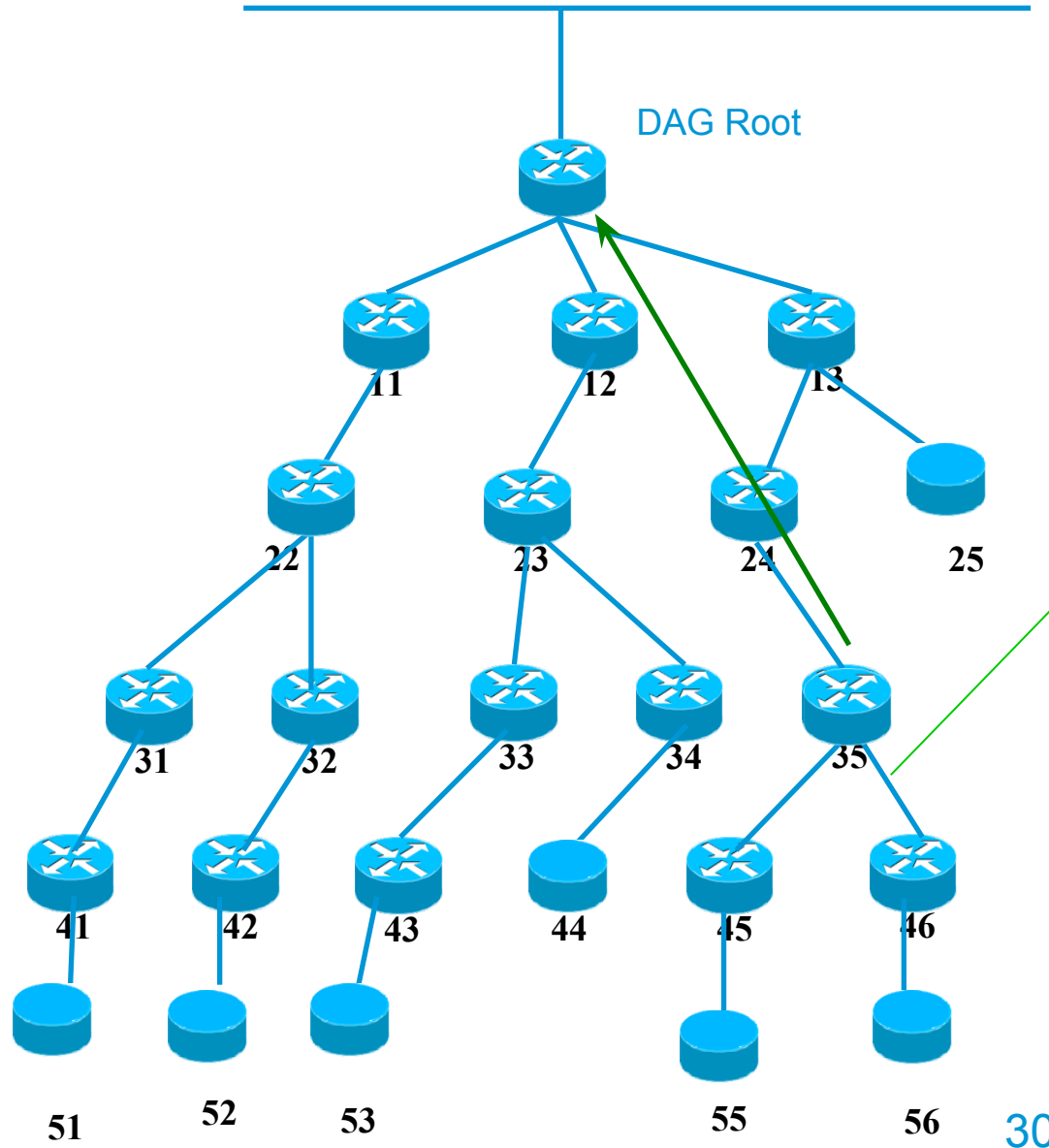Pascal Thubert

IETF 93

Prague, July 2025

Application
Server D
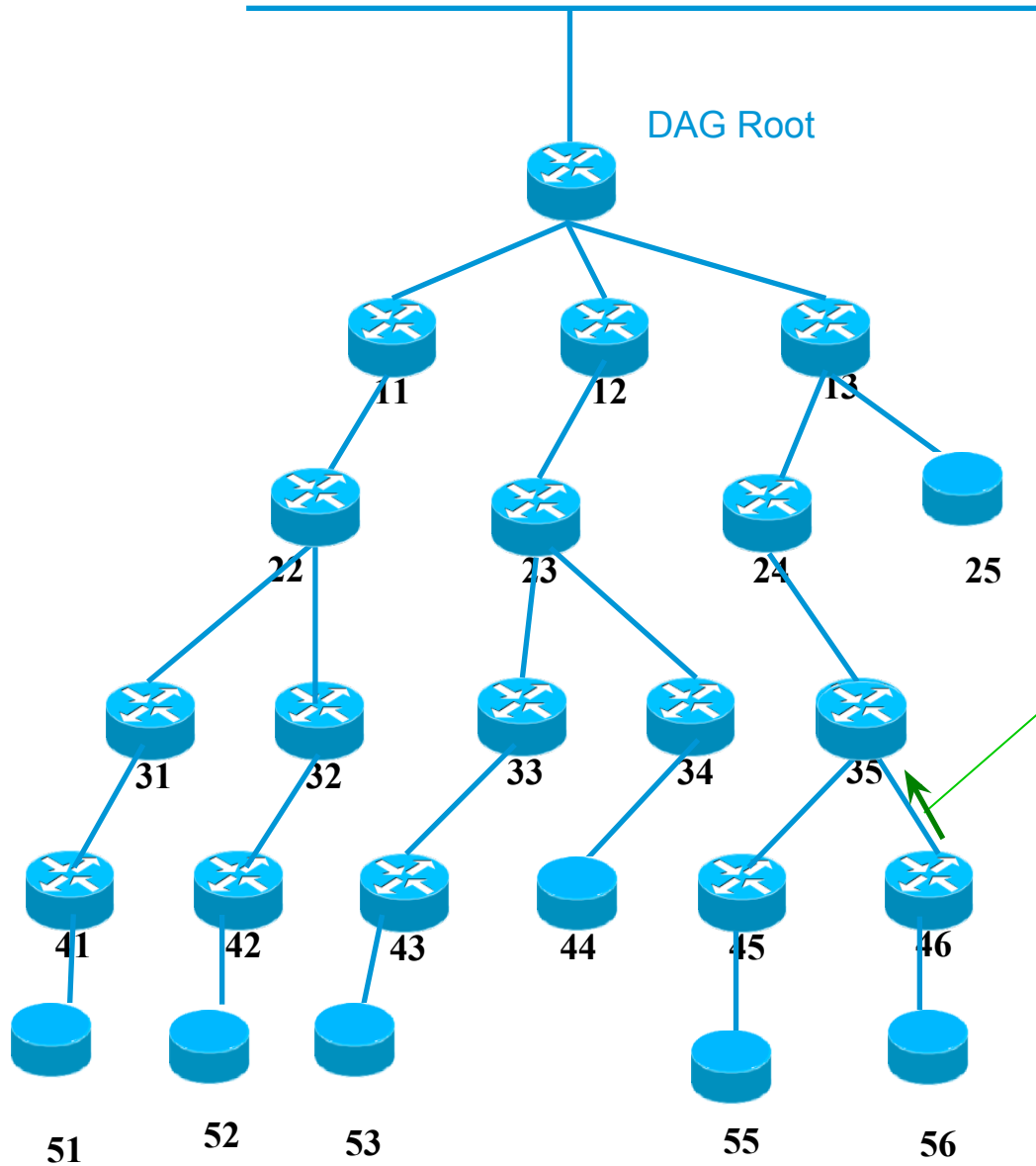
DAG Root

11      12      13

22      23      24      25

31      32      33      34      35

41      42      43      44      45      46

51      52      53      55      56

Application Server D

DAG Root

11    12    13

22    23    24    25

31    32    33    34    35

41    42    43    44    45    46

51    52    53    55    56

DAO with path segment unicast to target 56 via 35 (ingress)

28

Application Server D

DAG Root

11  12  13

22  23  24  25

31  32  33  34  35

41  42  43  44  45  46

51  52  53  55  56

Storing mode DAO (forced) with lifetime along segment

29

Application Server D

DAG Root

DAO-ACK (alt: non storing DAO) unicast, self 35 as parent, final destination 56 as target

11  12  13

22  23  24  25

31  32  33  34  35

41  42  43  44  45  46

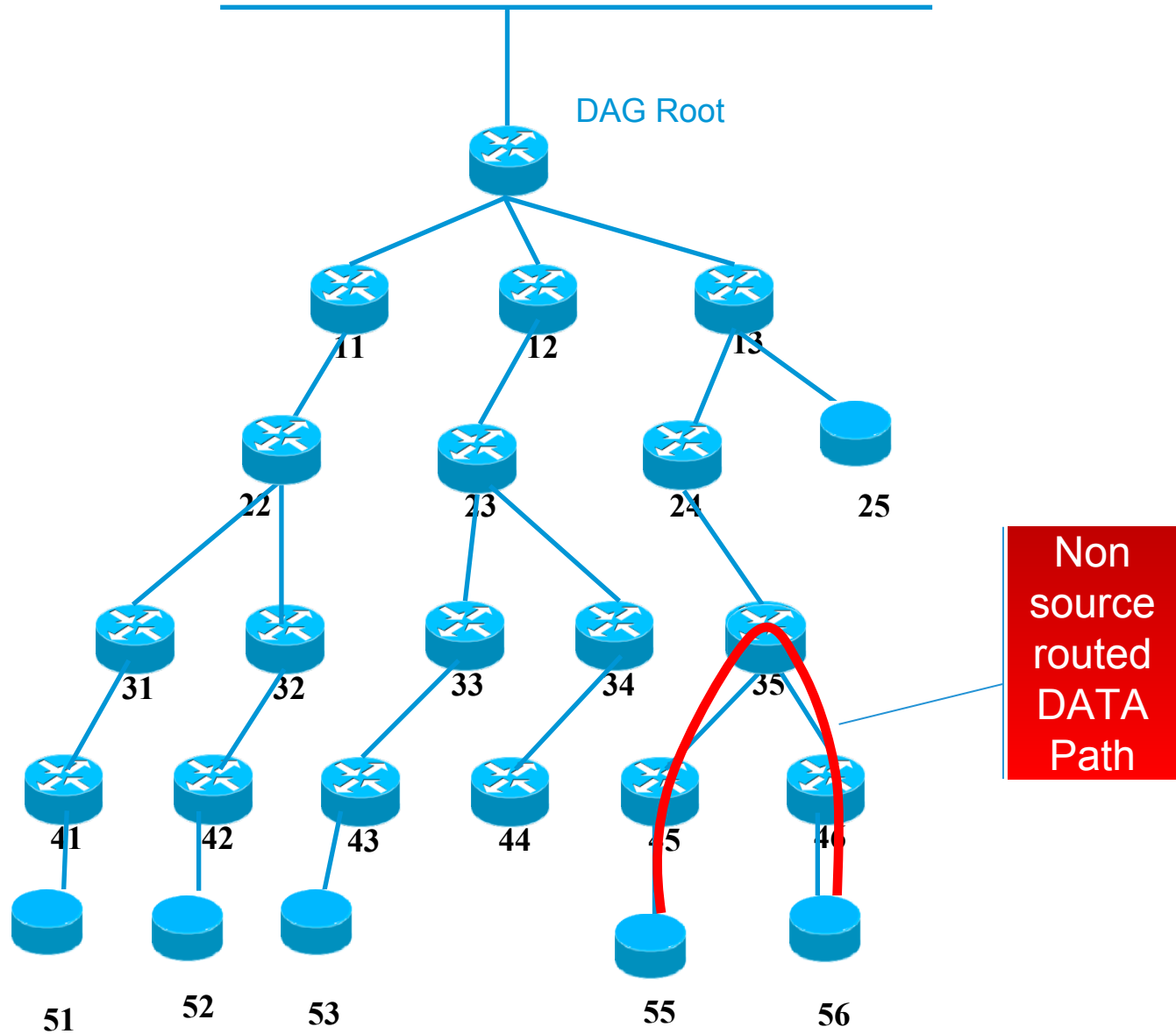51  52  53  55  56

30

Application Server D

DAG Root
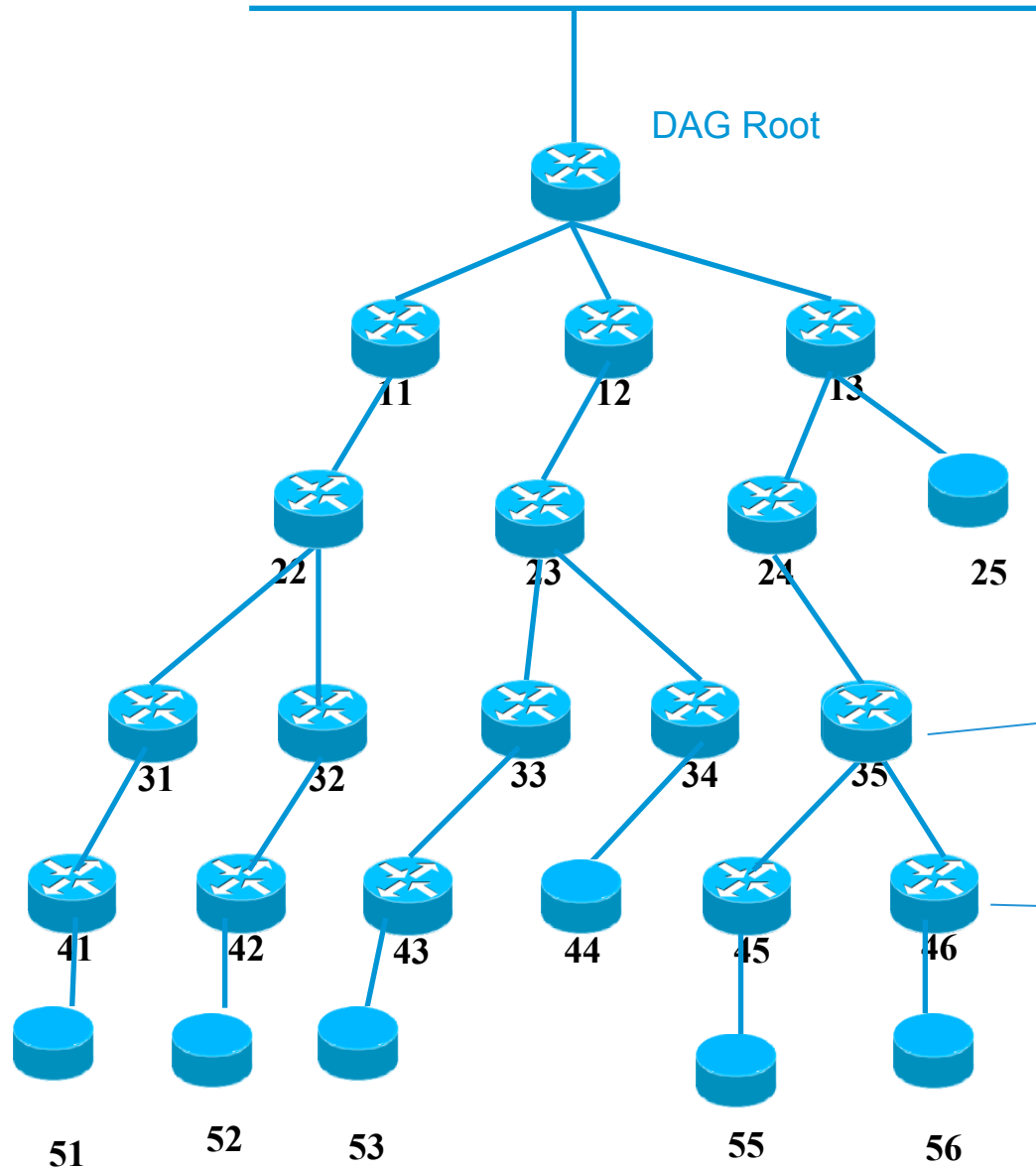
DAO from 46 installs a route to 56 in 35 (all nodes in projected route from ingress included to egress excluded) => egress should already have a route to target

11  12  13

22  23  24  25

31  32  33  34  35

56 via 46

41  42  43  44  45  46

Preexisting connected route to 56

51  52  53  55  56

31

Application Server D

DAG Root

11   12   13

22   23   24   25

31   32   33   34   35

41   42   43   44   45   46

51   52   53   55   56

Non source routed DATA Path

32

Application Server D

DAG Root
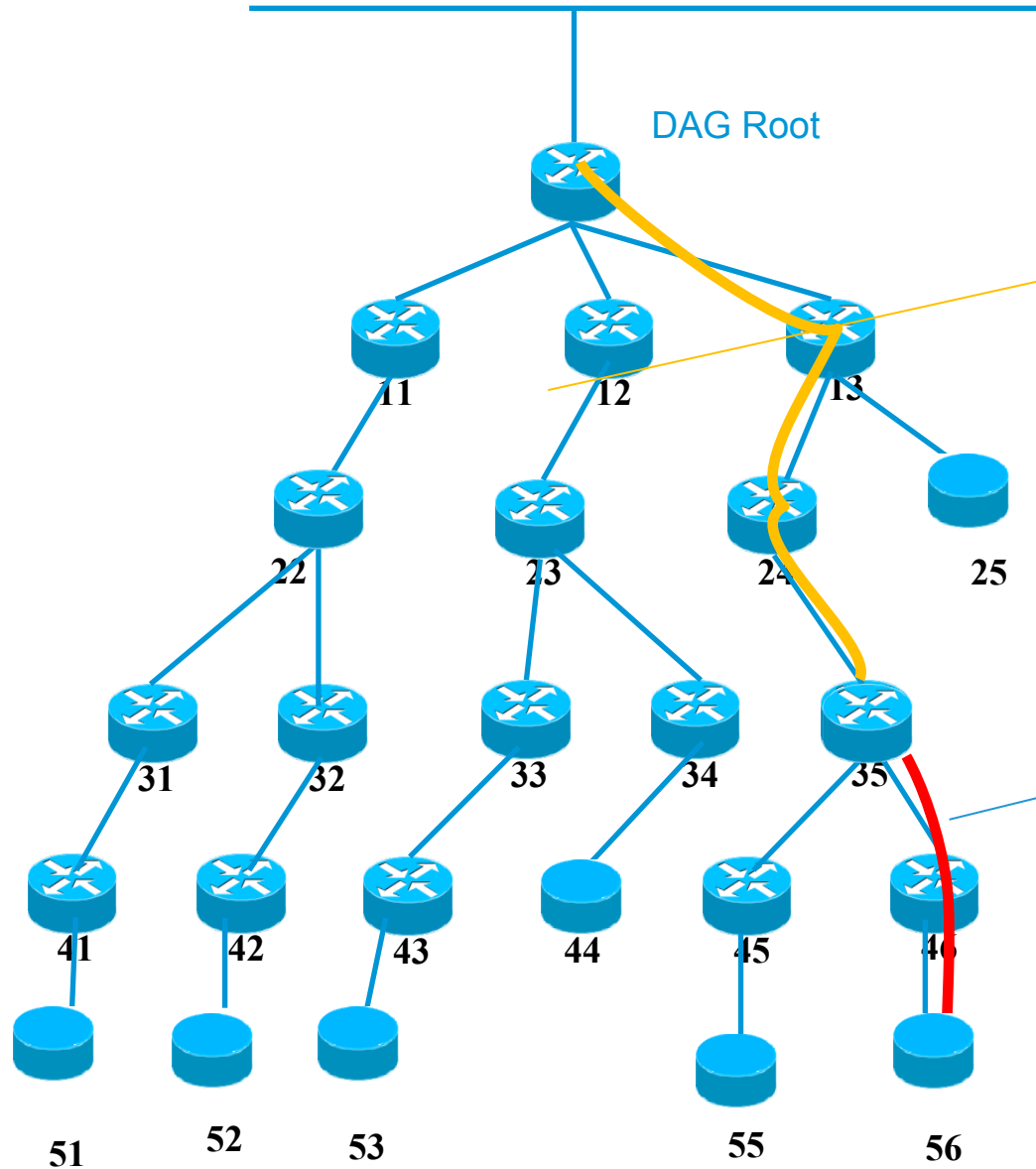
Loose Source routed DATA Path Packet to 12, RH 24, 35, 56

11  12  13

22  23  24  25

31  32  33  34  35

41  42  43  44  45  46
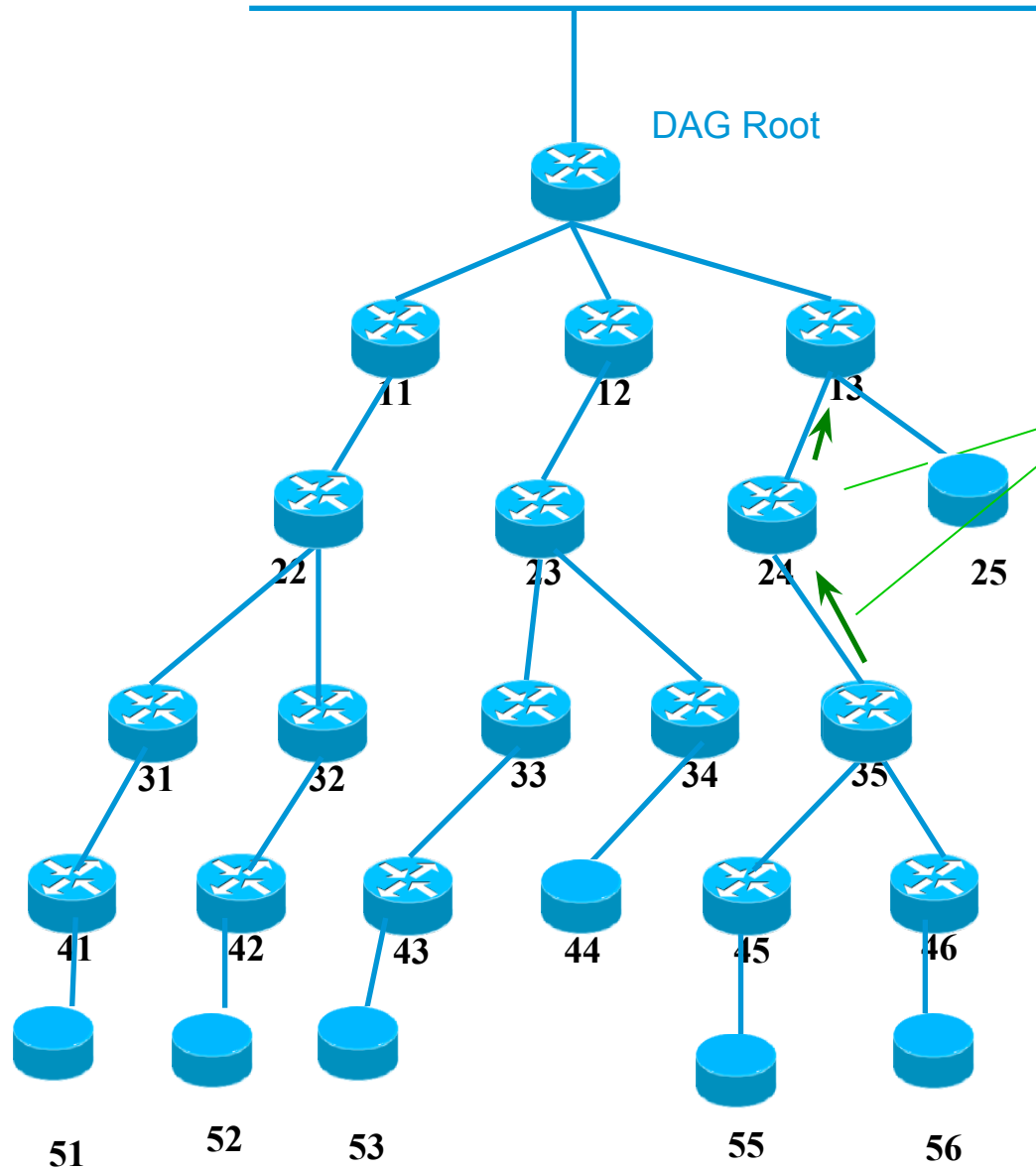
Non source routed DATA Path

51  52  53  55  56

Application Server D

DAG Root

11

12

13
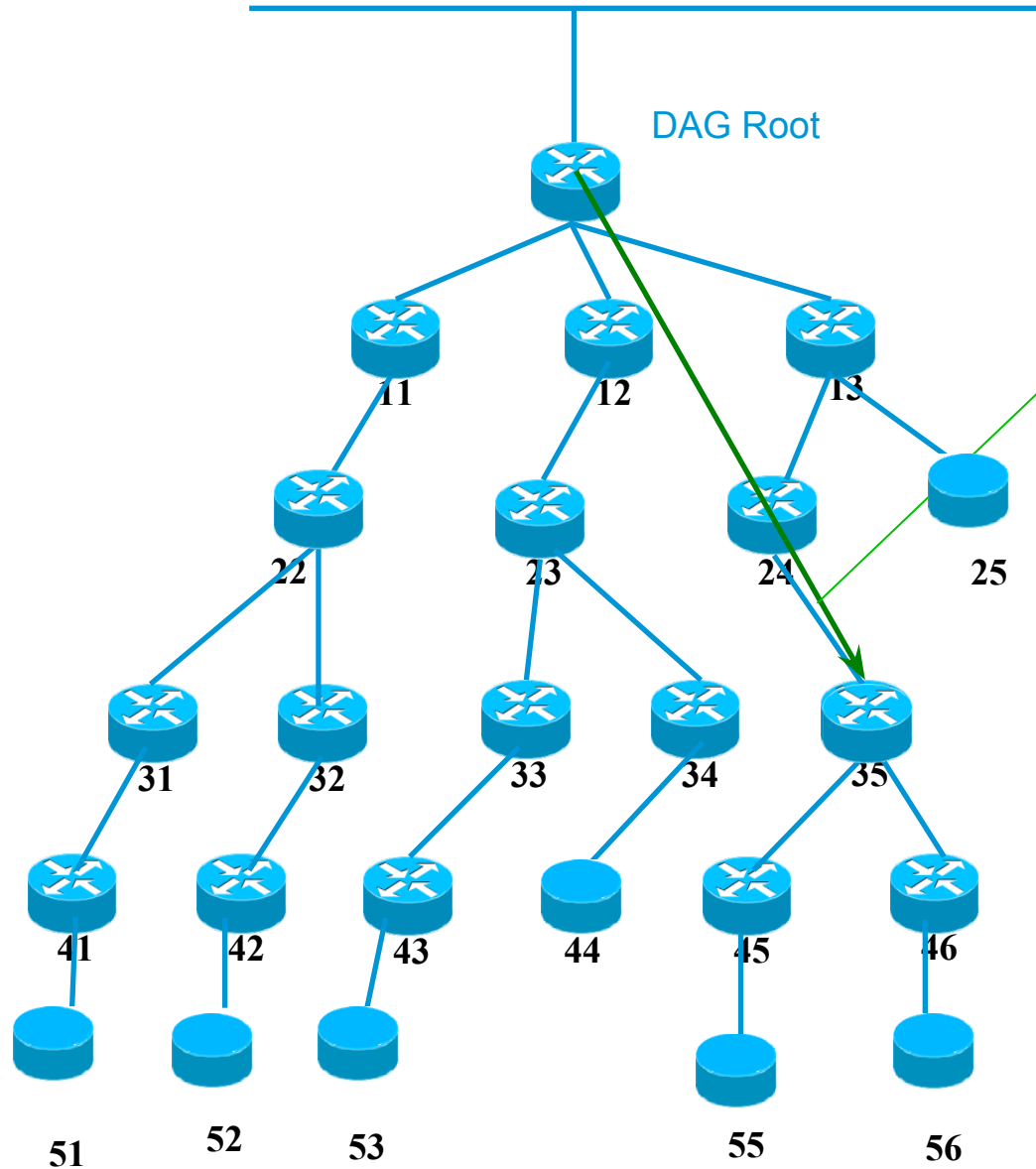
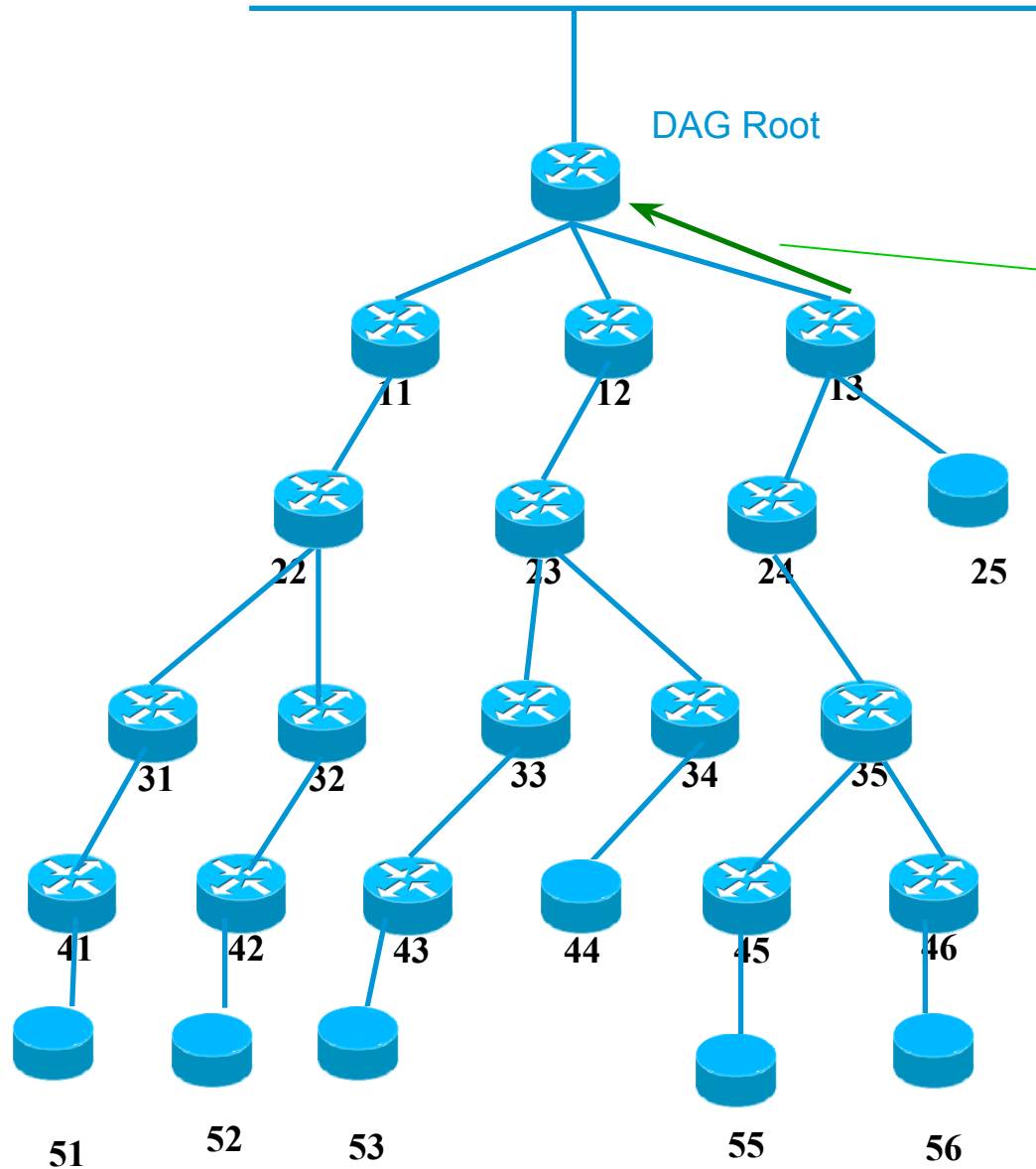Adding New (projected) DAO with path segment unicast to target 56 via 13 (ingress), 24, and 35 (egress)

22

23

24

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32

33

34

35

41

42

43

44

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52

53

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56

34

Application
Server D

DAG Root

Storing
mode DAO
(forced) with
lifetime
along
segment

11      12      13

22      23      24      25

31      32      33      34      35

41      42      43      44      45      46

51      52      53      55      56

35

Application Server D

DAG Root

DAO-ACK (alt: non storing DAO) unicast, self 13 as parent, final destination 56 as target

11

12

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44

45

46

51

52

53

55

56

36

Application Server D

DAG Root

56 via 24

56 via 35

56 via 46

Preexisting connected route to 56

11 12 13

22 23 24 25

31 32 33 34 35

41 42 43 44 45 46

51 52 53 55 56

37

Application
Server D

DAG Root

11

12

13

22

23

24

25

31

32

33

34

35

41

42

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44

45

46

Non source
routed
DATA Path

51

52

53

55

56
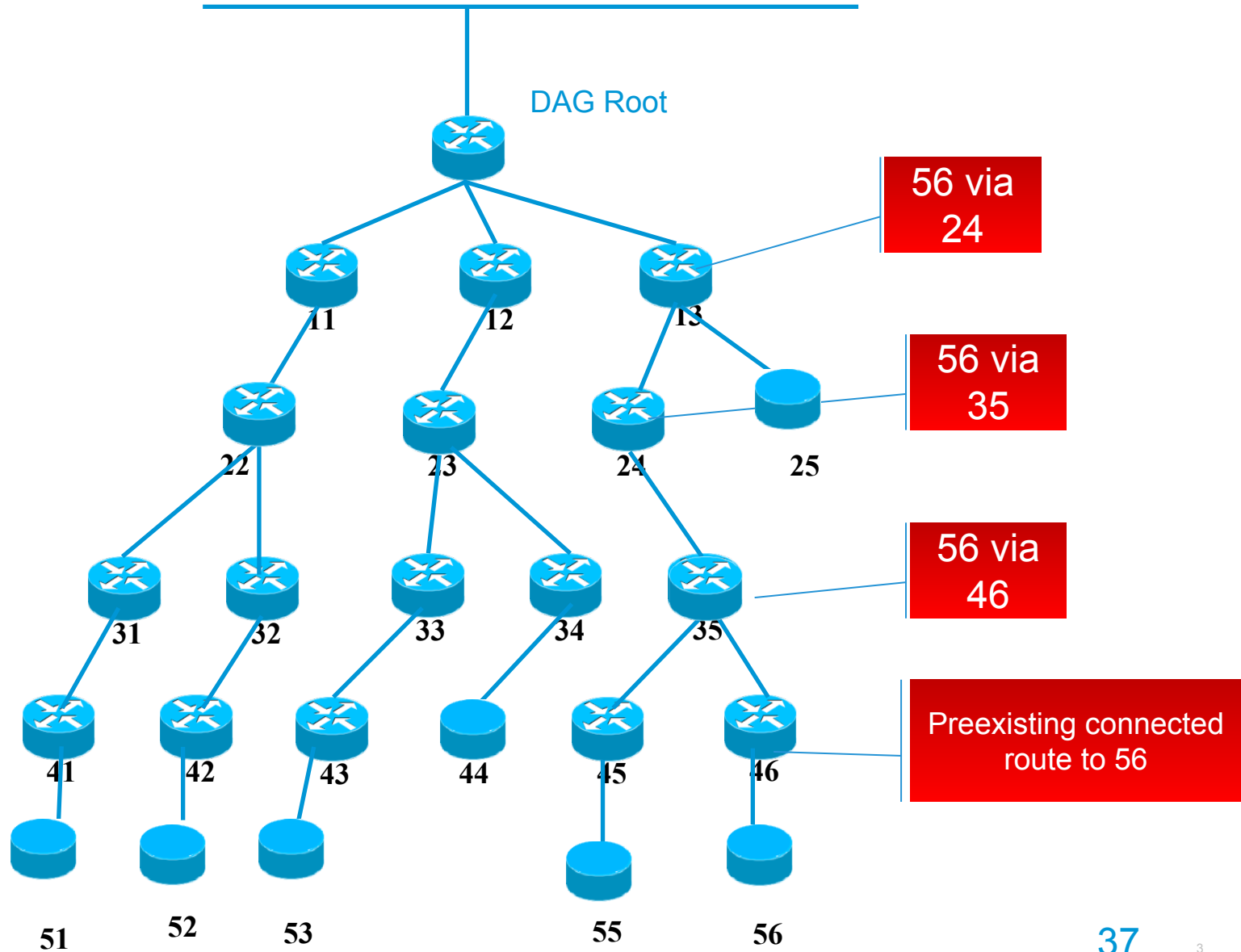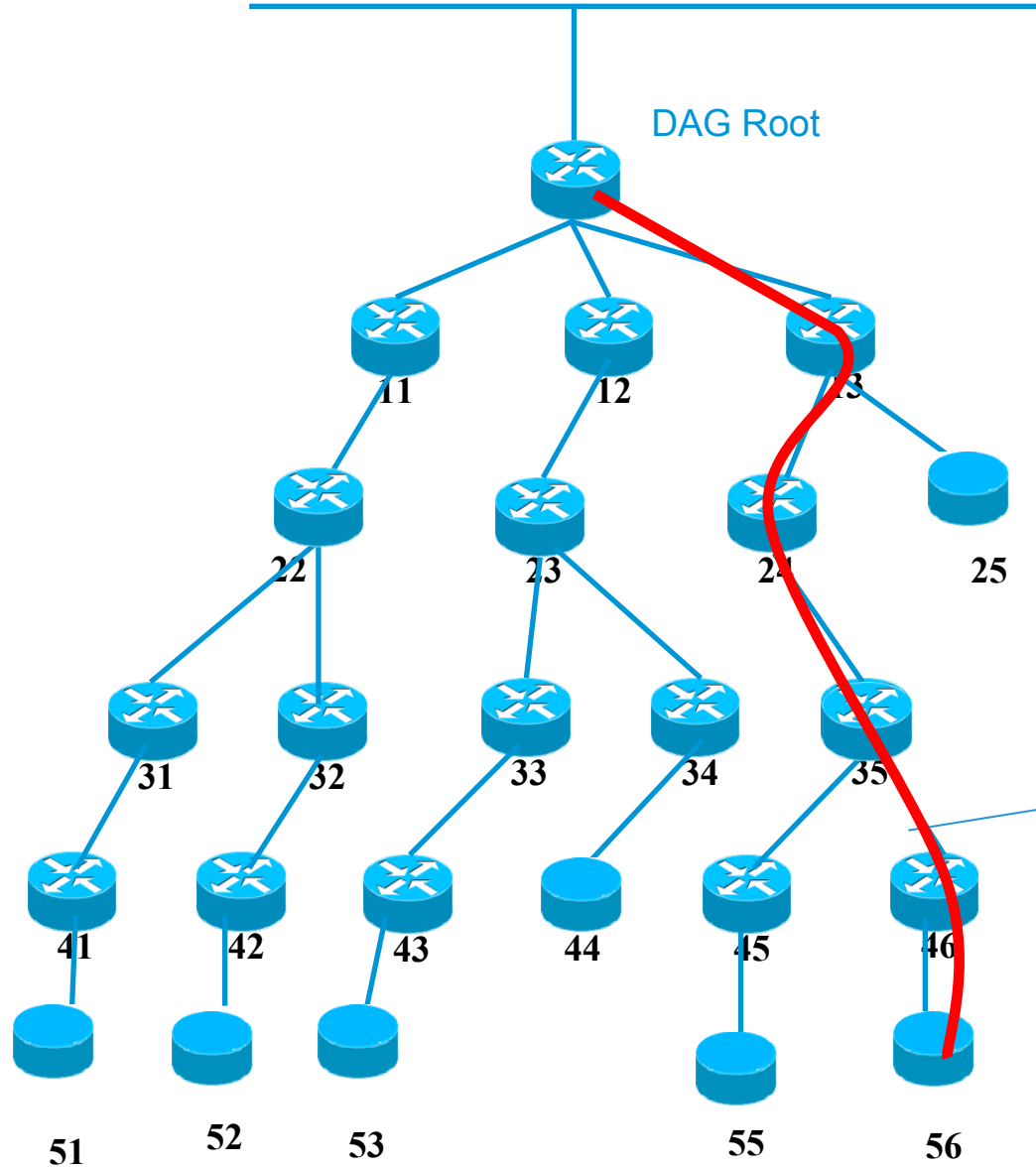
Alternate Programming By the root (Michael)

Application Server D
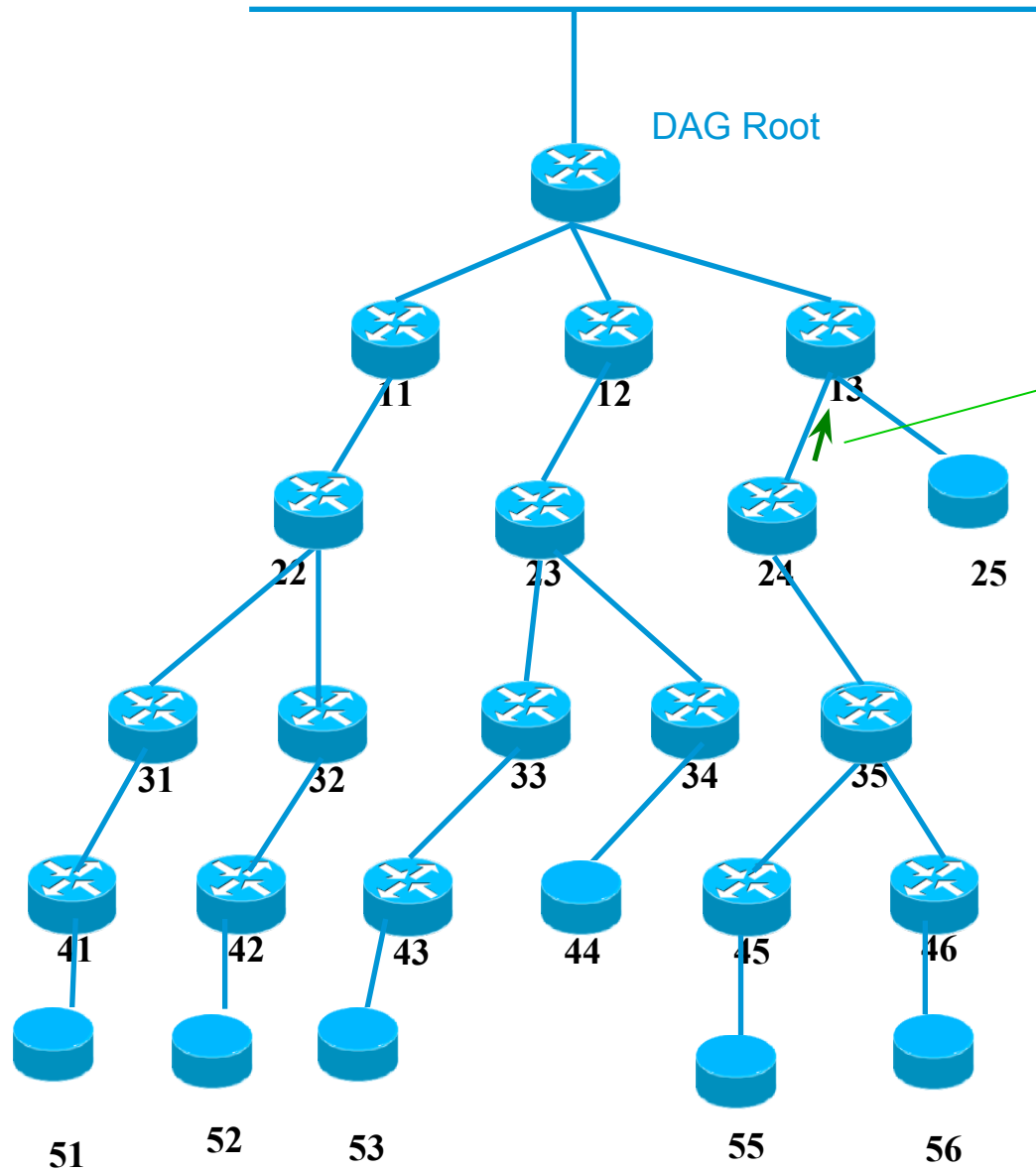
DAG Root
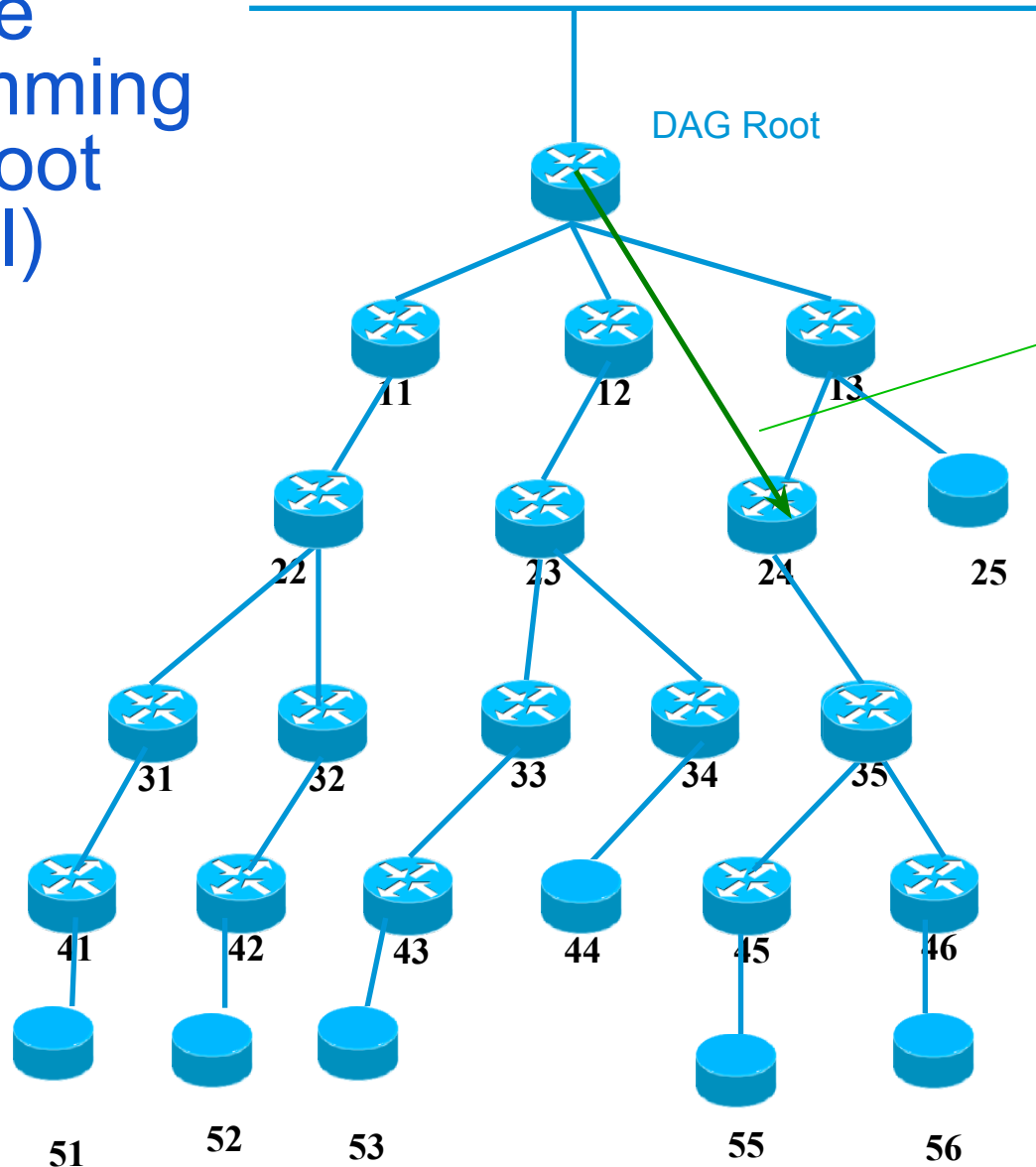
ALT: Adding New (projected) DAO with path segment unicast to target 35 via 13 (ingress) and 24 (egress)

39

Application Server D

DAG Root
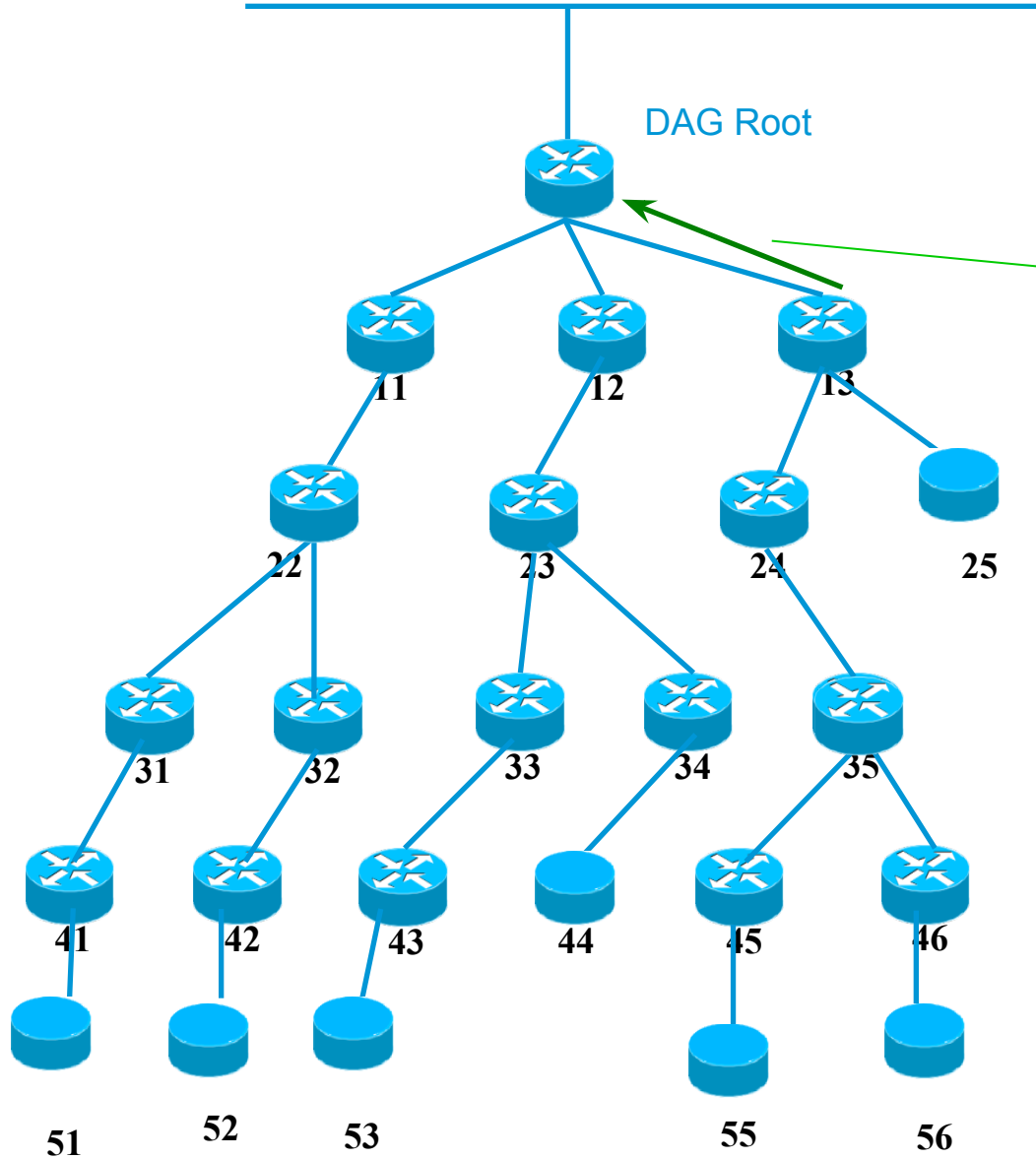
Storing mode DAO (forced) with lifetime along segment

11    12    13

22    23    24    25

31    32    33    34    35

41    42    43    44    45    46

51    52    53    55    56

40

Application Server D

DAG Root

**11**   **12**   **13**

**22**   **23**   **24**   **25**

**31**   **32**   **33**   **34**   **35**

**41**   **42**   **43**   **44**   **45**   **46**

**51**   **52**   **53**   **55**   **56**

DAO-ACK (alt: non storing DAO) unicast, self 13 as parent, final destination 56 as target

41

Application Server D

DAG Root

35 via 24

11

12

13

Preexisting connected route to 35

22

23

24

25

56 via 46

31

32

33

34

35

Preexisting connected route to 56

41

42

43

44

45

46

51

52

53

55

56

42

Application Server D

DAG Root

Loose Source routed DATA Path Packet to 35, RH 56

routed DATA Path

routed DATA Path

11    12    13

22    23    24    25

31    32    33    34    35

41    42    43    44    45    46

51    52    53    55    56

43
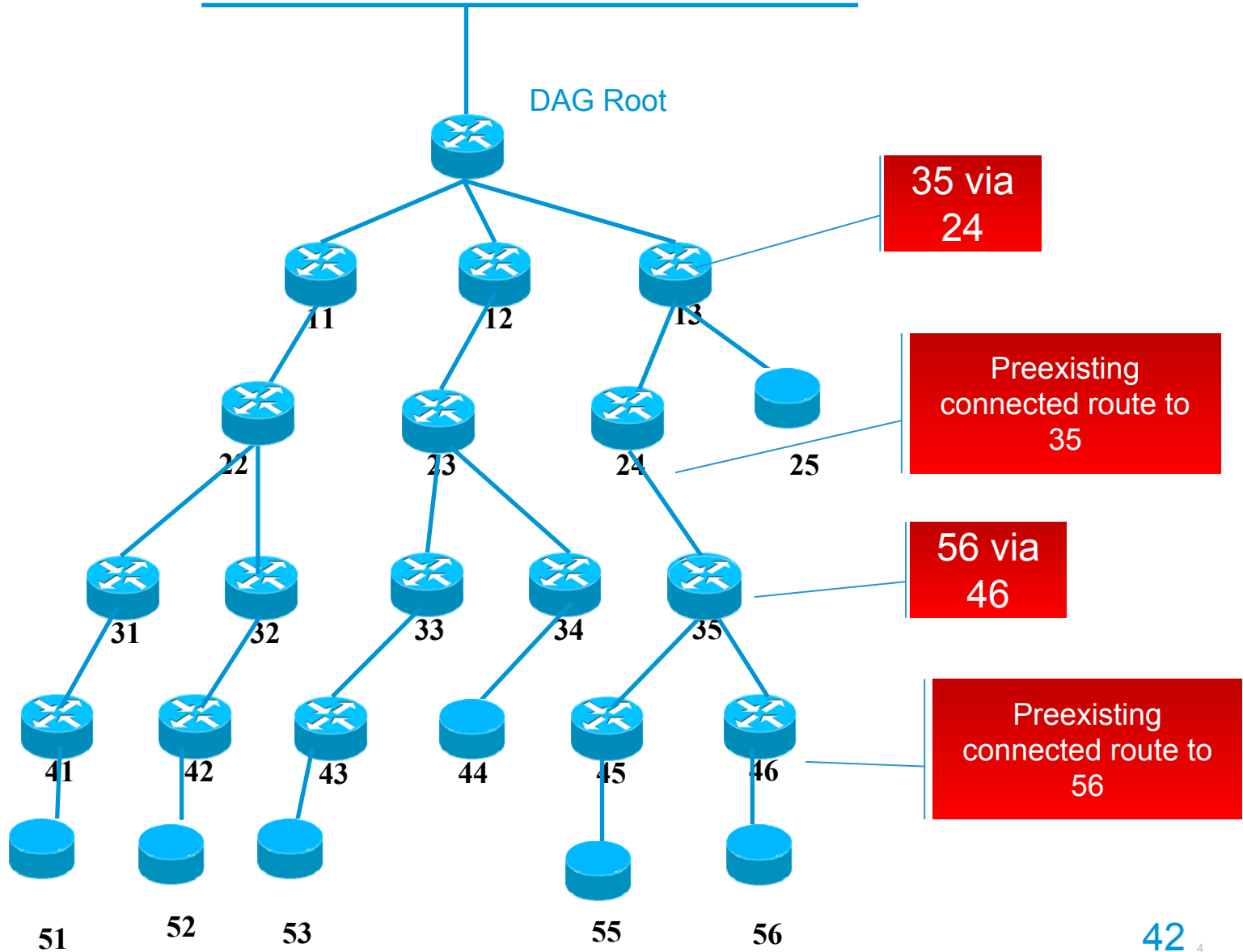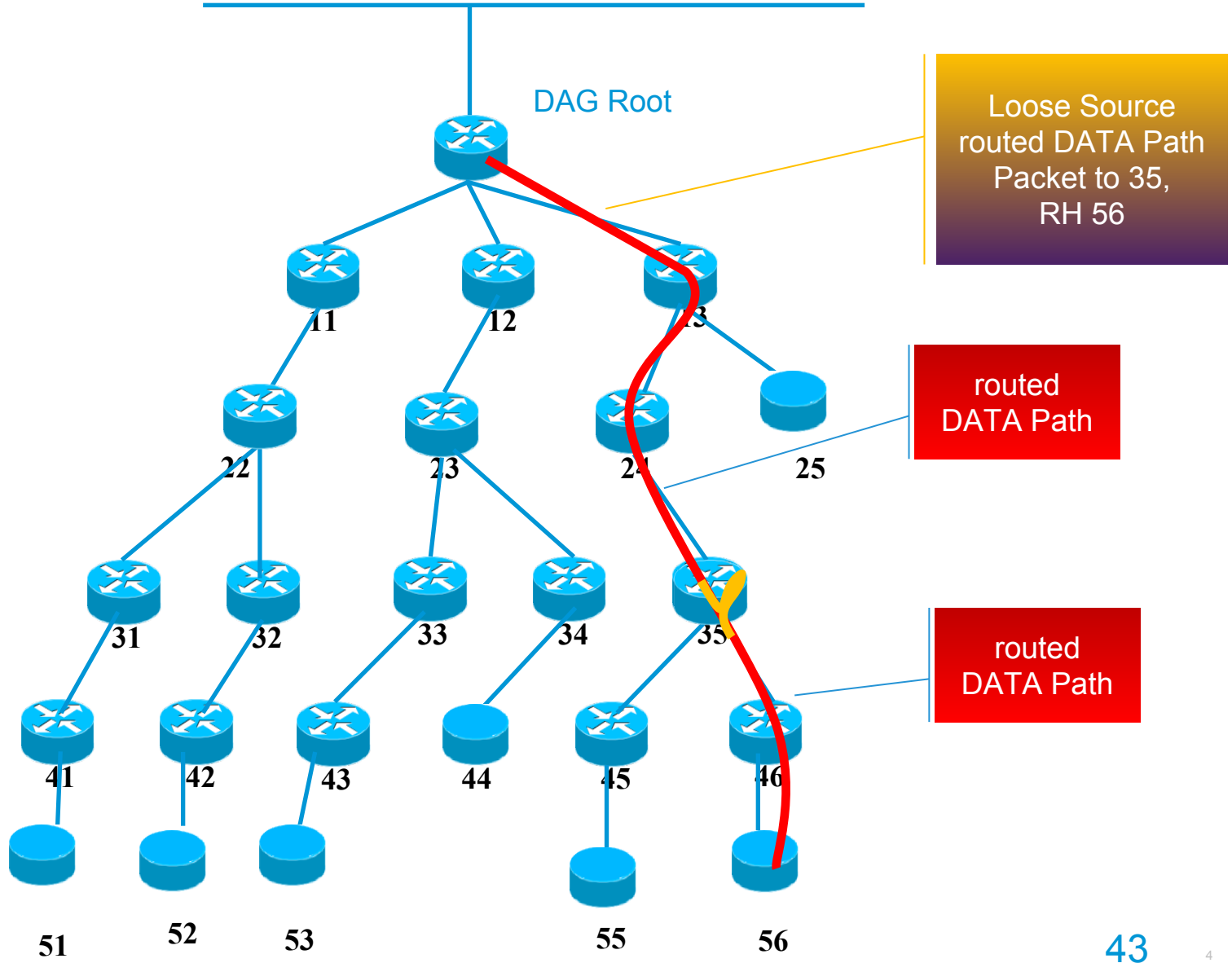
# Questions on the list

- Terminology:

   Segment vs. projected route

   New msg for "projected DAO"

- Need for a new MOP?

   Suggestion to add a capability
   option in node's original DAOs

- DAO direction, clarify flows

- Transversal routes

- DAO-ACK request bit
  setting

- -> or non storing DAO?

# Open Floor

THANKS!