IETF 94 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/ietf94/roll
- Etherpad:
  - http://tools.ietf.org/wg/roll/minutes
- Audio Streaming:
- Minutes taker:
- Jabber Scribe:
- **Please sign blue sheets :-)**

Agenda

- State of: (10 minutes)
  - Work item
  - ROLL I-D
  - Related I-D
  - Open Issues
- draft-robles-roll-useofrplinfo-02 (30 min)
- draft-thubert-roll-dao-projection-02 (10 min)
- Open floor (10 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-11	Ready to be submitted to IESG
draft-ietf-roll-applicability-home-building-12	RFC Editor Queue
draft-ietf-roll-applicability-template-07	Stable - not to be published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-08	New version should address comments of IESG

Related Internet-Drafts

draft-robles-roll-useofrplinfo-02	When to use RFC 6553, 6554 and IPv6-in-IPv6	Slides Today
draft-thubert-roll-dao-projection-02	Root initiated routing state in RPL	Slides Today
draft-tan-roll-clustering-00	RPL-based Clustering Routing Protocol	Future Discussion
draft-turner-roll-dio-ctx-00	RPL DIO Option for Specifying Compression Contexts	Future Discussion
draft-wang-roll-adaptive-data-aggregation	Design of Adaptive Data Aggregation Schemes	Future Discussion
draft-zhong-roll-dis-modifications-00	DIS Modifications	Future Discussion

Open Tickets

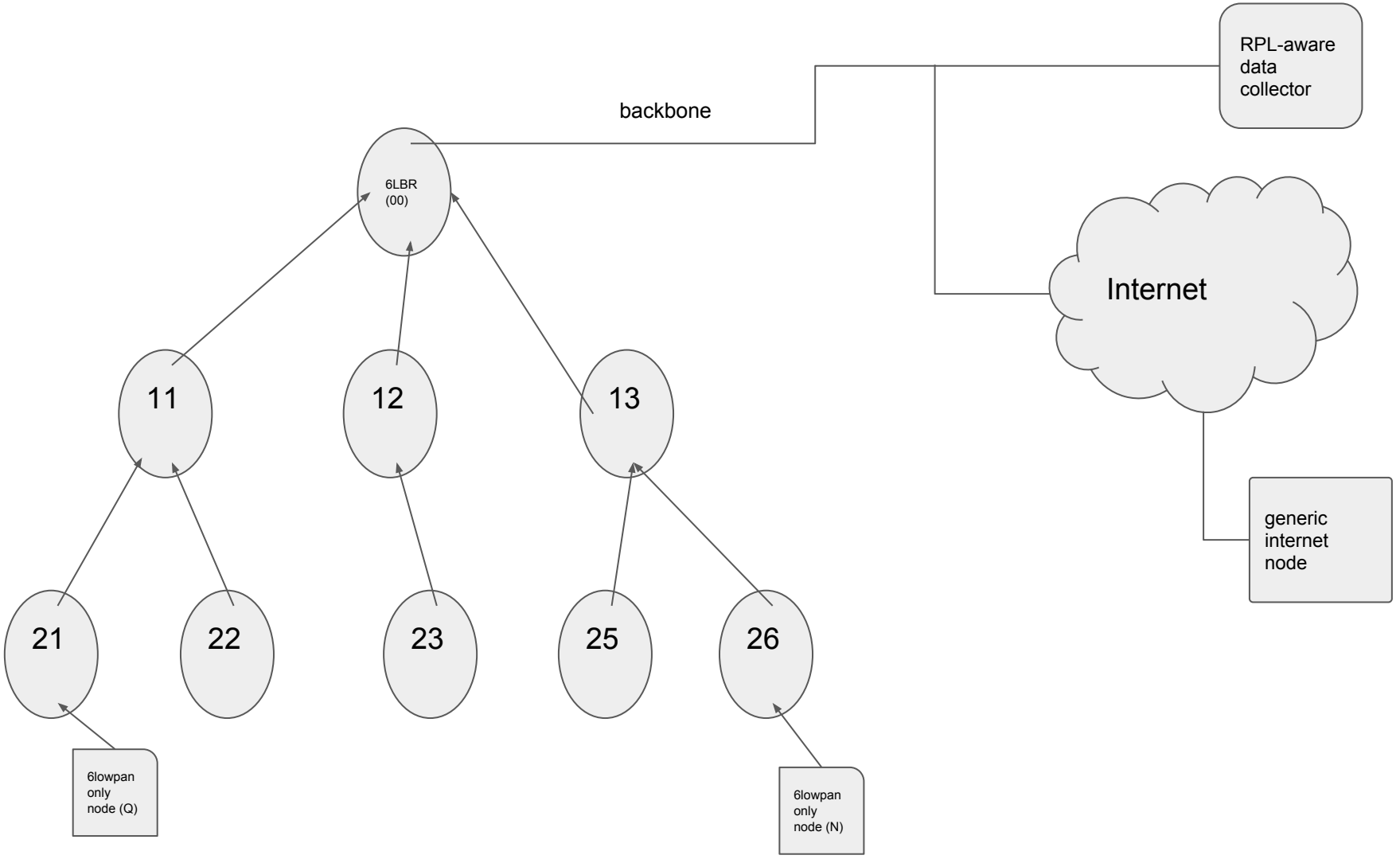
Ticket	Summary
#169	Work Item Proposals
#170	Use of ESC Dispatch value in new IETF header compression

RPL RPI/RH3 uses

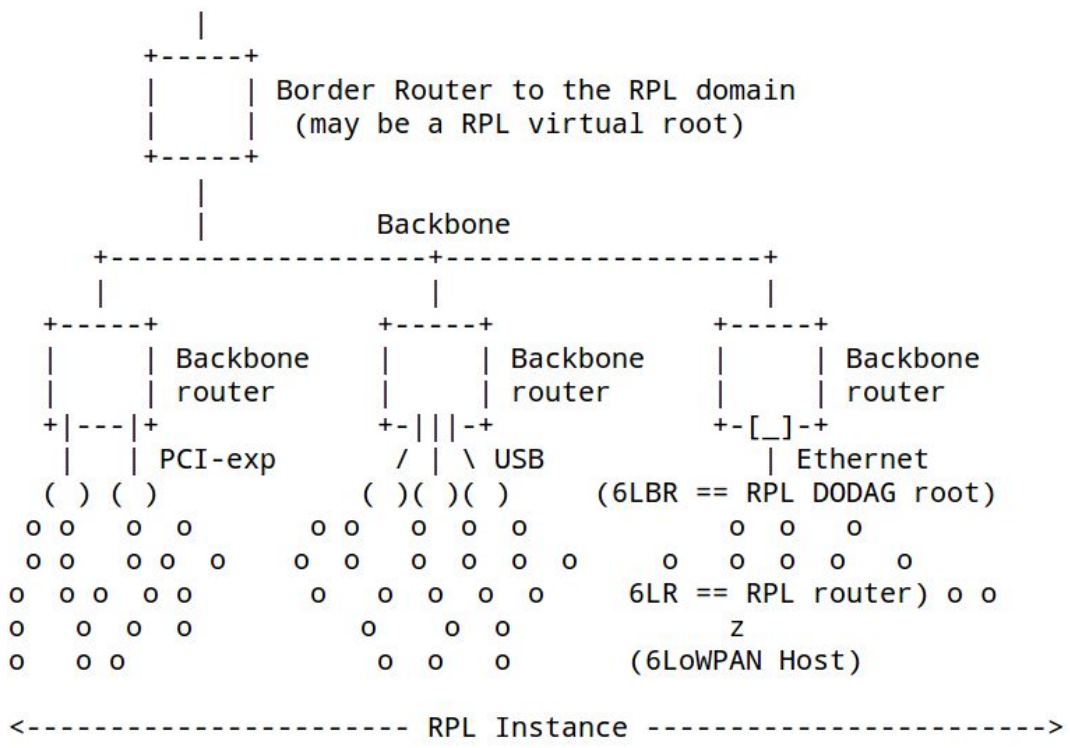
draft-robles-roll-useofrpi

Michael Richardson
Pascal Thubert
Ines Robles

structure of network - reference diagram



RPL Domain Architecture



Rules for the Proposed Scenarios

-This document assumes a rule that a **Header cannot be inserted or removed on the fly inside an IPv6 packet that is being routed**.

- This means that an **intermediate router that needs to add a header must encapsulate the packet in an outer IP header where the new header can be placed.**

- This also means that a Header can only be removed by an intermediate router if
  - it is placed in an encapsulating IPv6 Header,
  - and that the IPv6 header is *addressed* to that intermediate router!

The whole encapsulating header must be removed - a replacement may be added though.

- **RPI should be present in every single RPL data packet**

  the **rank** is important, especially in storing-mode, even if there is only one RPLinstanceID

  There is an exception in non-storing mode, when a packet is going down from the route: the entire route is written, so there are no loops of confusion about which table to use (purpose of instanceID).

Scenarios analyzed in draft-robles-roll-useofrpi
work done at virtual interim working meeting, September 29.

{Storing,Non-Storing} X {RPL-aware-leaf,non-RPL-aware,root, Internet} X {RPL-aware-leaf,non-RPL-aware,root,Internet}

(but Internet->Internet cases removed, so 24, not 32)

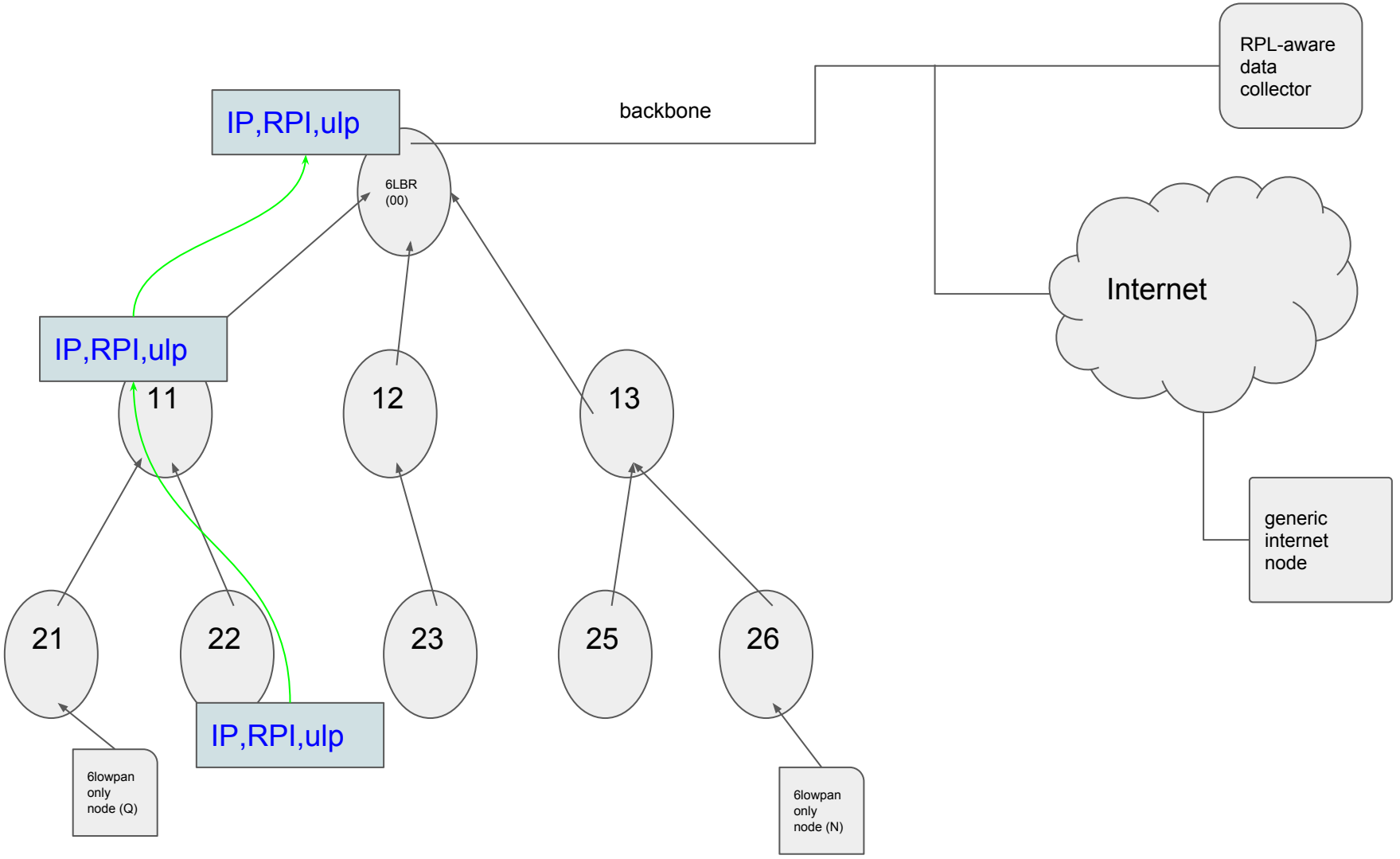
STORING

1. Flow from RPL-aware-leaf to root
2. Flow from root to RPL-aware-leaf
3. Flow from non-RPL-aware-leaf to root
4. Flow from root to non-RPL-aware-leaf
5. Flow from RPL-aware-leaf to Internet
6. Flow from Internet to RPL-aware-leaf
7. Flow from non-RPL-aware-leaf to Internet
8. Flow from Internet to non-RPL-aware-leaf
9. Flow from RPL-aware-leaf to RPL-aware-leaf
10. Flow from RPL-aware-leaf to non-RPL-aware-leaf
11. Flow from non-RPL-aware-leaf to RPL-aware-leaf
12. Flow from non-RPL-aware-leaf to non-RPL-aware-leaf

NON-STORING

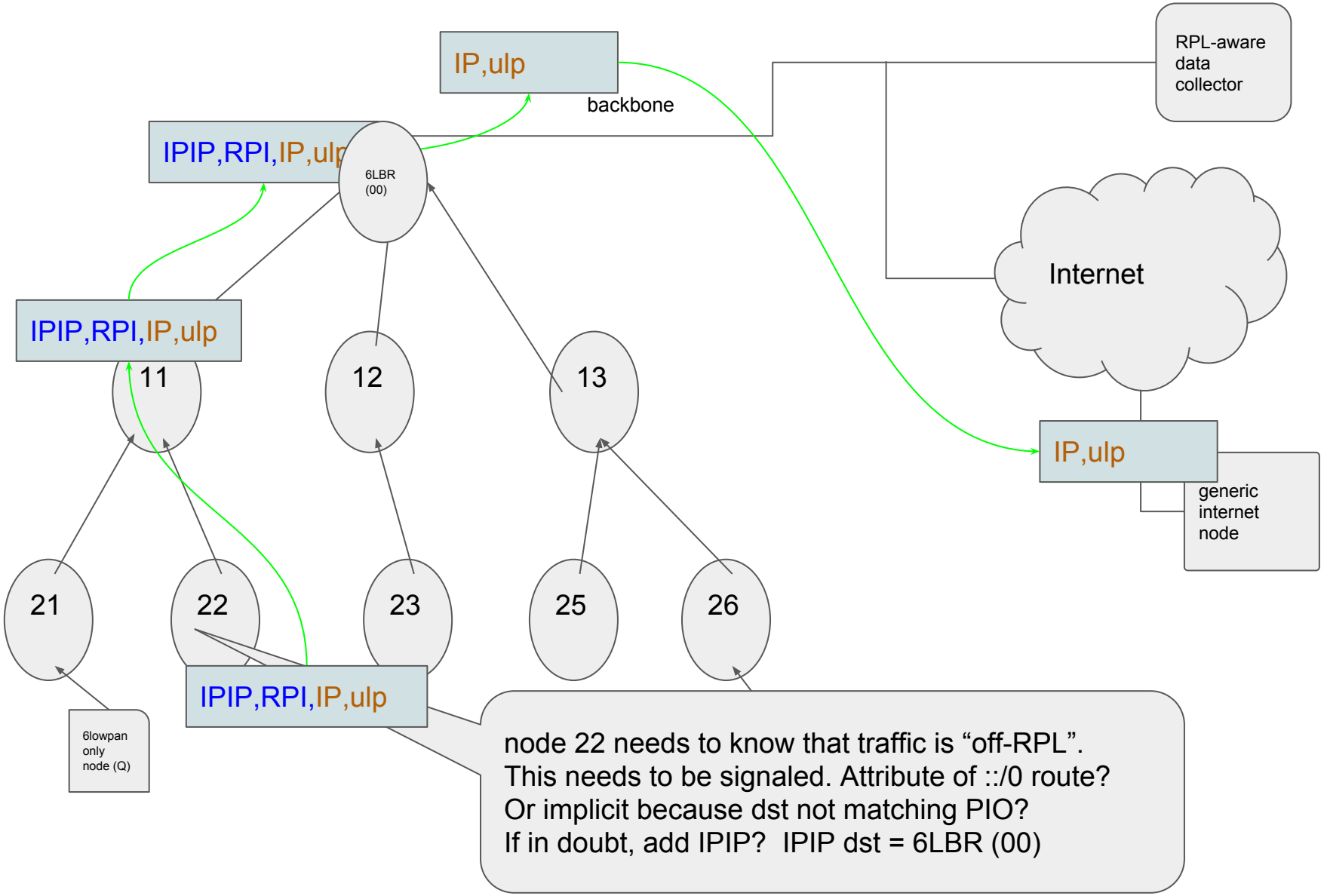
13. Flow from RPL-aware-leaf to root
14. Flow from root to RPL-aware-leaf
15. Flow from non-RPL-aware-leaf to root
16. Flow from root to non-RPL-aware-leaf
17. Flow from RPL-aware-leaf to Internet
18. Flow from Internet to RPL-aware-leaf
19. Flow from non-RPL-aware-leaf to Internet
20. Flow from Internet to non-RPL-aware-leaf
21. Flow from RPL-aware-leaf to RPL-aware-leaf
22. Flow from RPL-aware-leaf to non-RPL-aware-leaf
23. Flow from non-RPL-aware-leaf to RPL-aware-leaf
24. Flow from non-RPL-aware-leaf to non-RPL-aware-leaf

no problems: storing-mode, Flow from RPL-aware-leaf to root

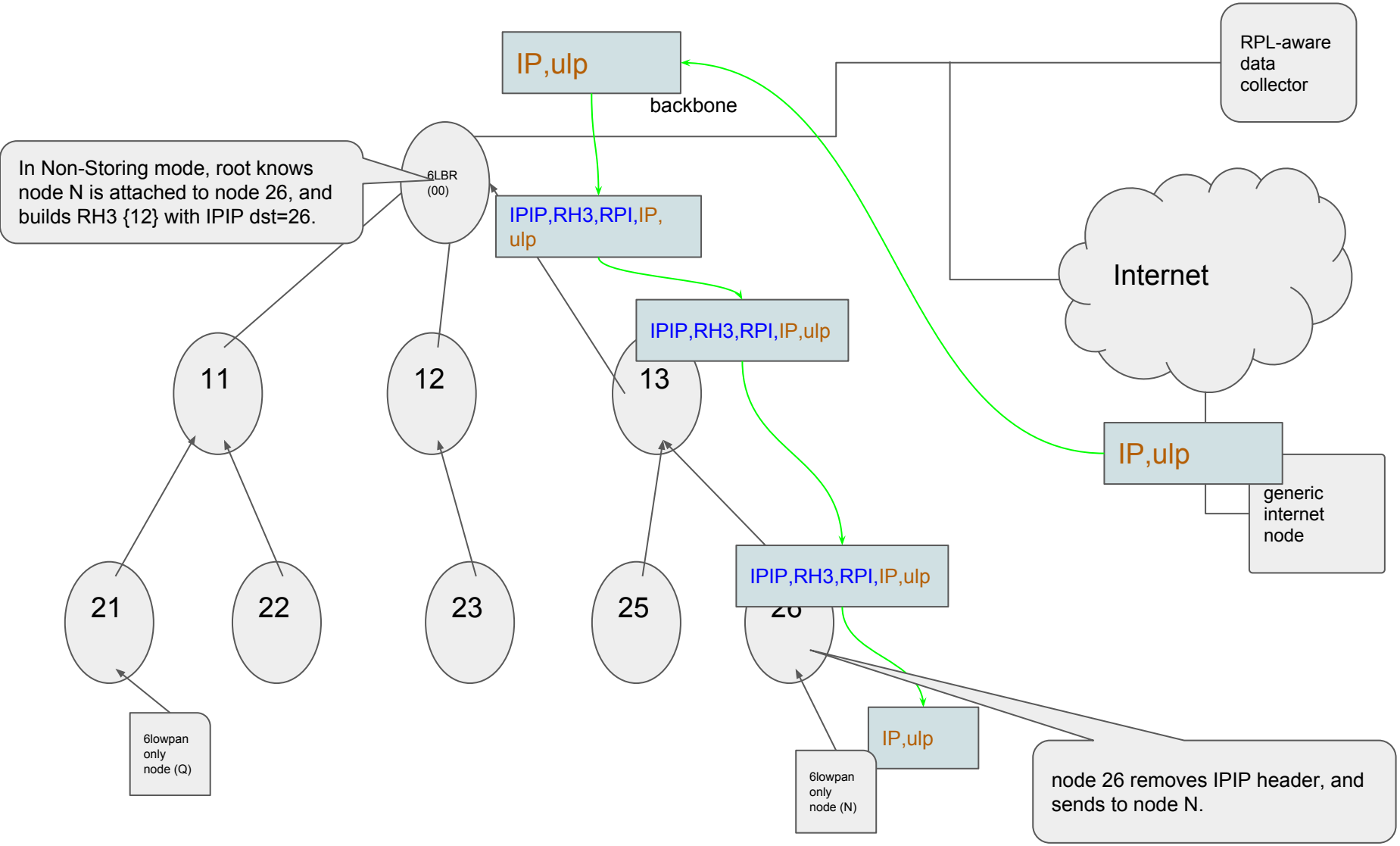


ulp - upper layer payload/protocol (e.g. UDP, TCP, etc.)

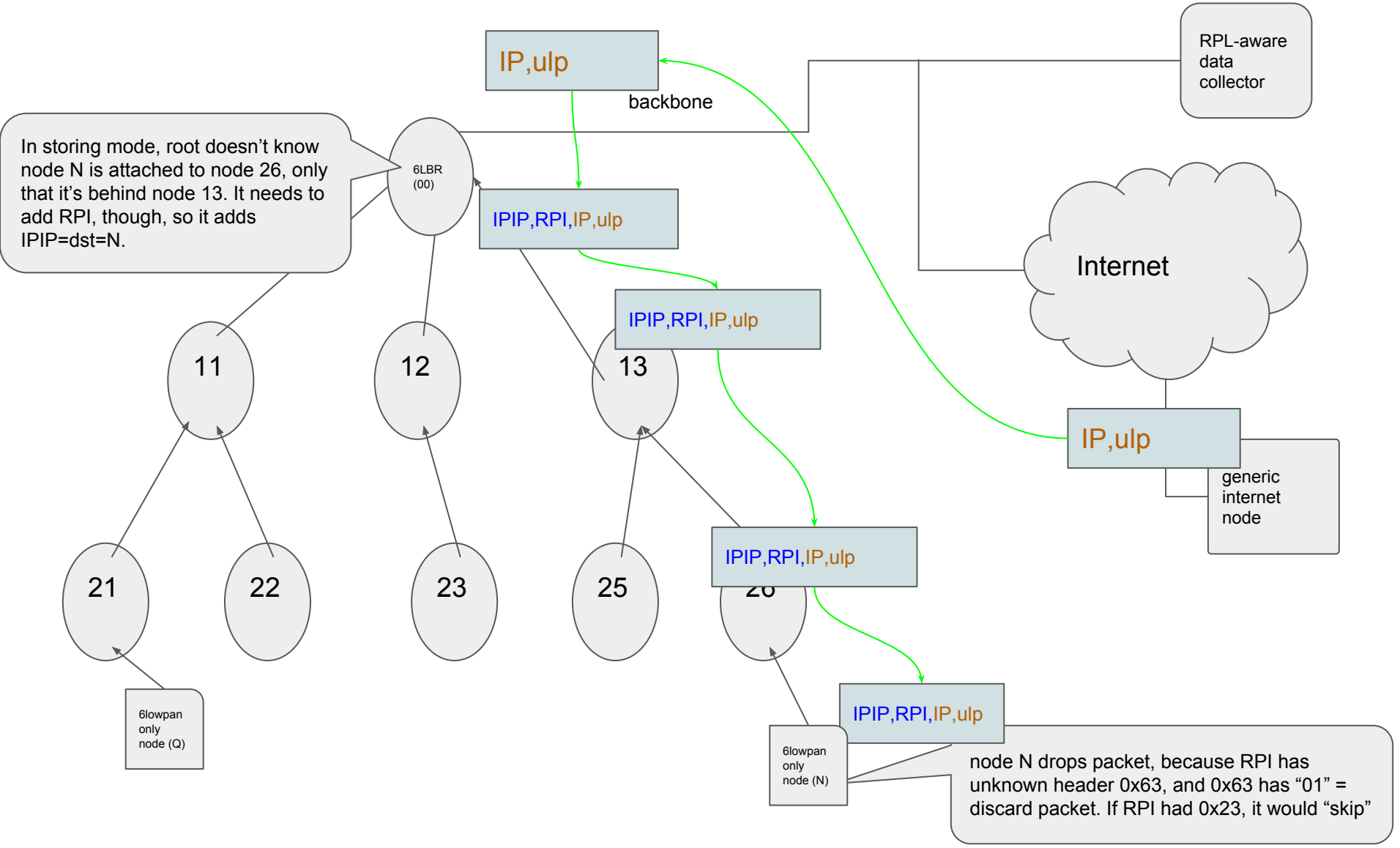
few problems: storing-mode, Flow from RPL-aware-leaf to Internet



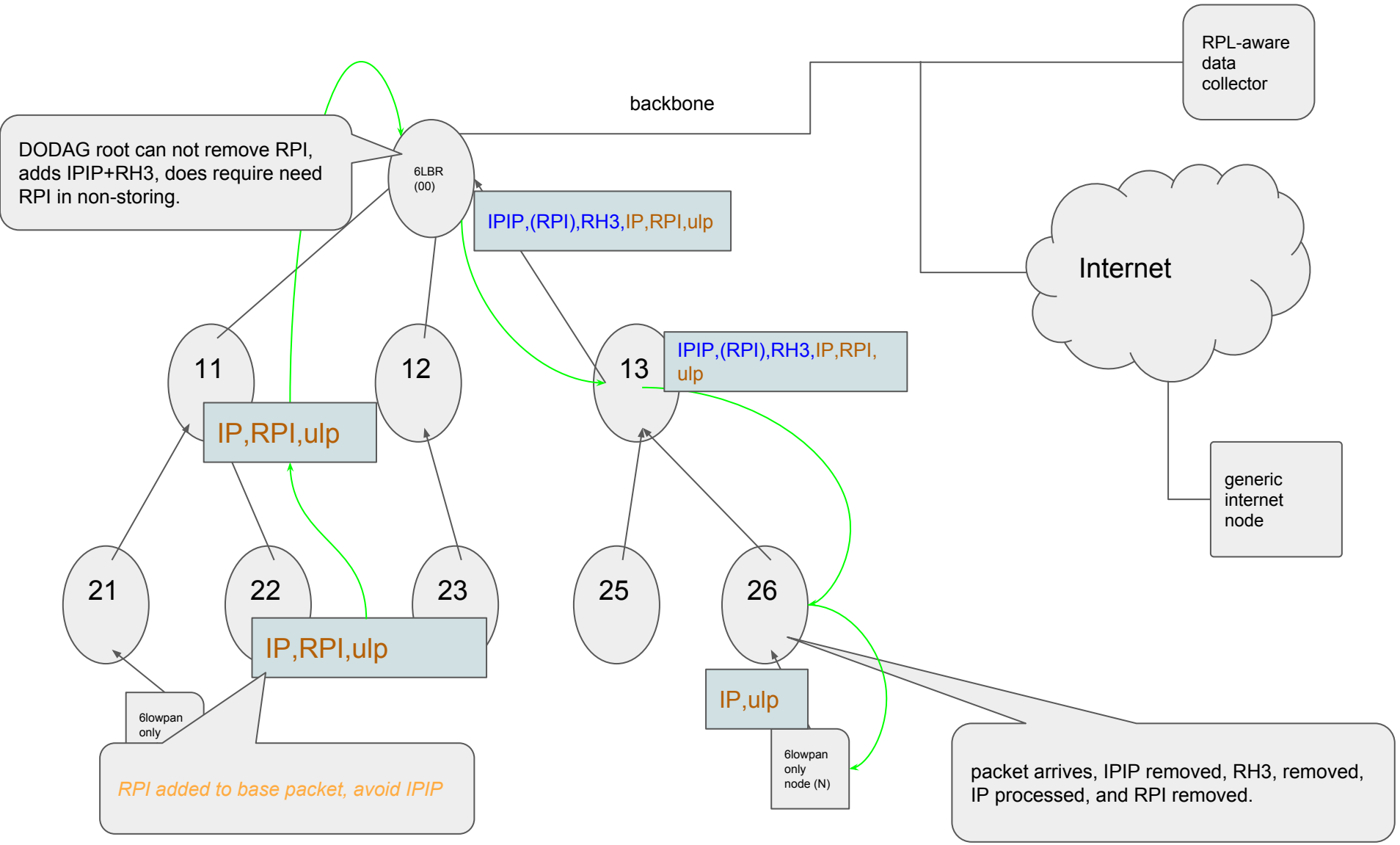
few problems: non-storing-mode Internet to non-RPL-aware-Leaf



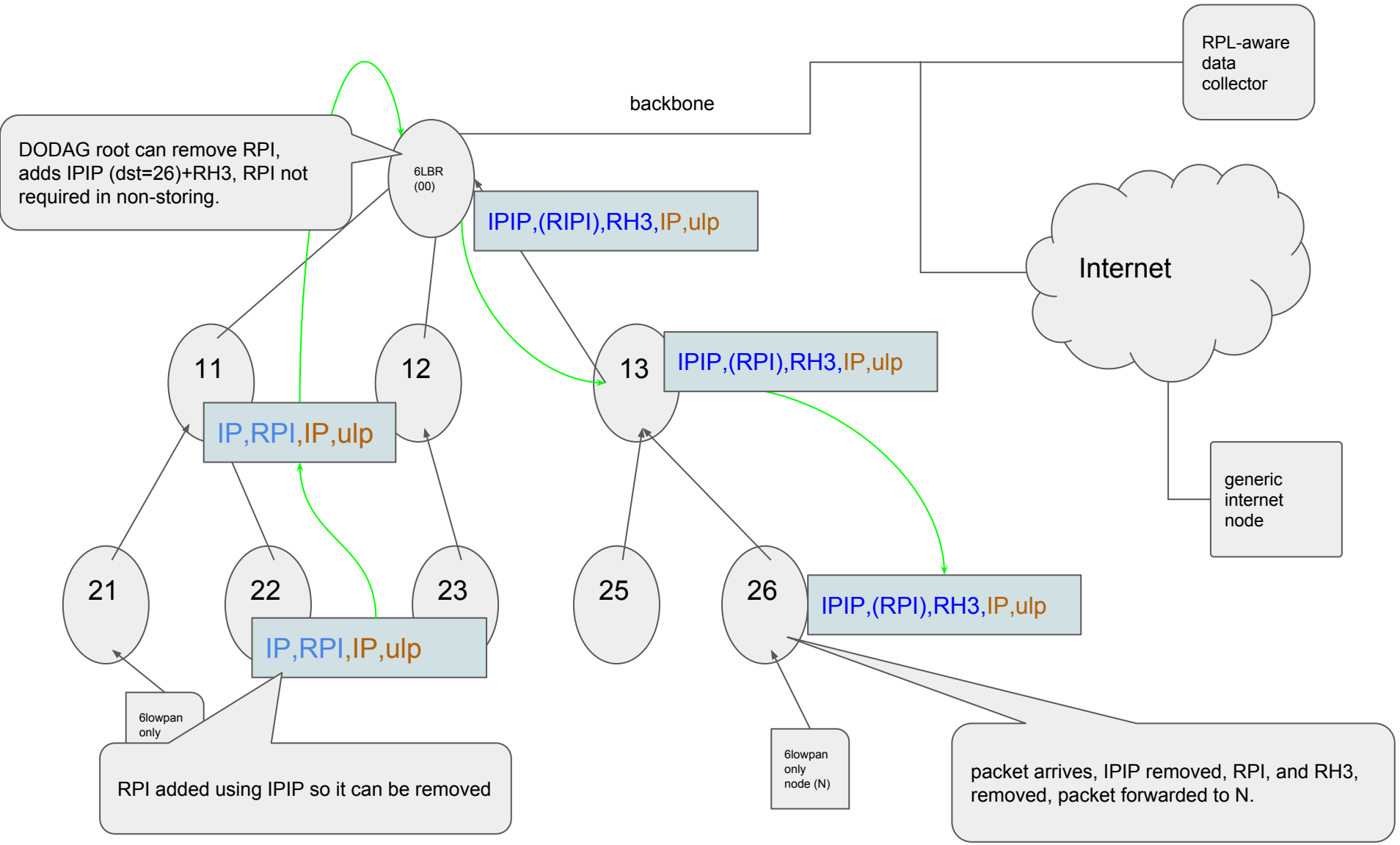
big problems: storing-mode Internet to non-RPL-aware-Leaf



no problems: non-storing-mode from RPL-aware-leaf to RPL-aware-leaf



few problems: non-storing-mode from RPL-aware-leaf to RPL-aware-leaf



Case that Fails: Storing From RPL aware to Non-RPL aware

Somehow, the sender has to know that the receiver is not RPL aware, and needs to know 6LR, and not even the root knows where the 6LR is (in storing mode). This case **FAILS**.

6LN --> 6LR --> common parent (6LR) --> 6LR --> not-RPL-aware 6LN

How to solve this?

Future RPL work

There are cases from above that are not clear how to send the information. It requires furhter analysis on how to proceed to send the information from source to destination.

we have in storing mode:

- Flow from RPL-aware-leaf to non-RPL-aware-leaf: Somehow, the sender has to know that the receiver is not RPL aware, and needs to know
6LR, and not even the root knows where the 6LR is located.

- Flow from not-RPL-aware-leaf to not-RPL-aware-leaf: The problem to solve is how to indicate where to send the packet when get into LLN.

Root initiated routing state in RPL

draft-thubert-dao-projection

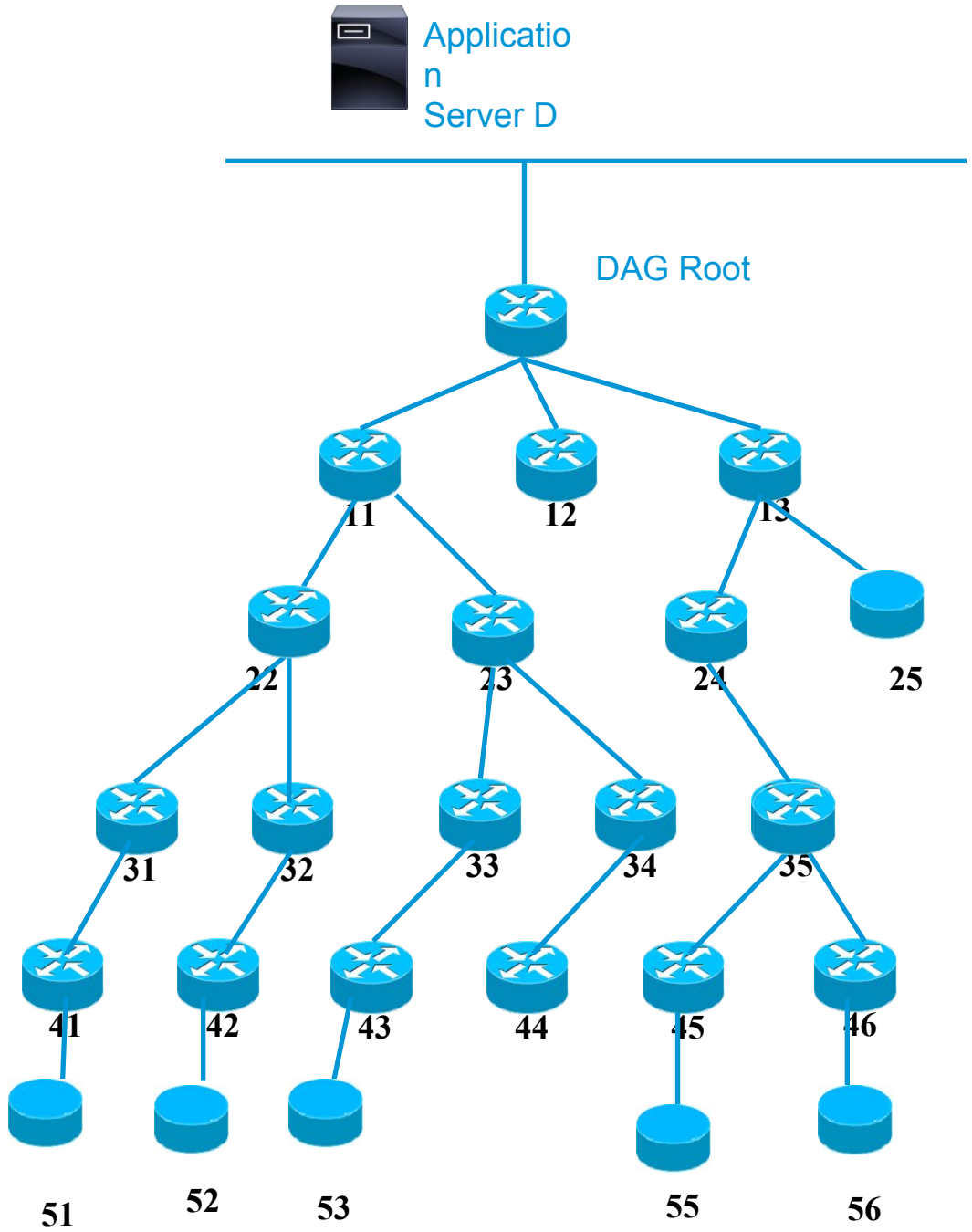
Pascal Thubert
IETF 94

Yokohama, November 2025

Highlights

- Allows for centralized routing computation with RPL
  - E.g. Root coordinates with PCE
- Need topological information and / or device constraints
  - e.g. how many routes can a given RPL router store?
  - Can leverage TEAS / DETNET work
  - Enough topology info in non-storing route optimization at the root
- New: Added support for transversal route
  - Works for storing and non storing routes

New generic route optimization


Application
Server D
DAG Root
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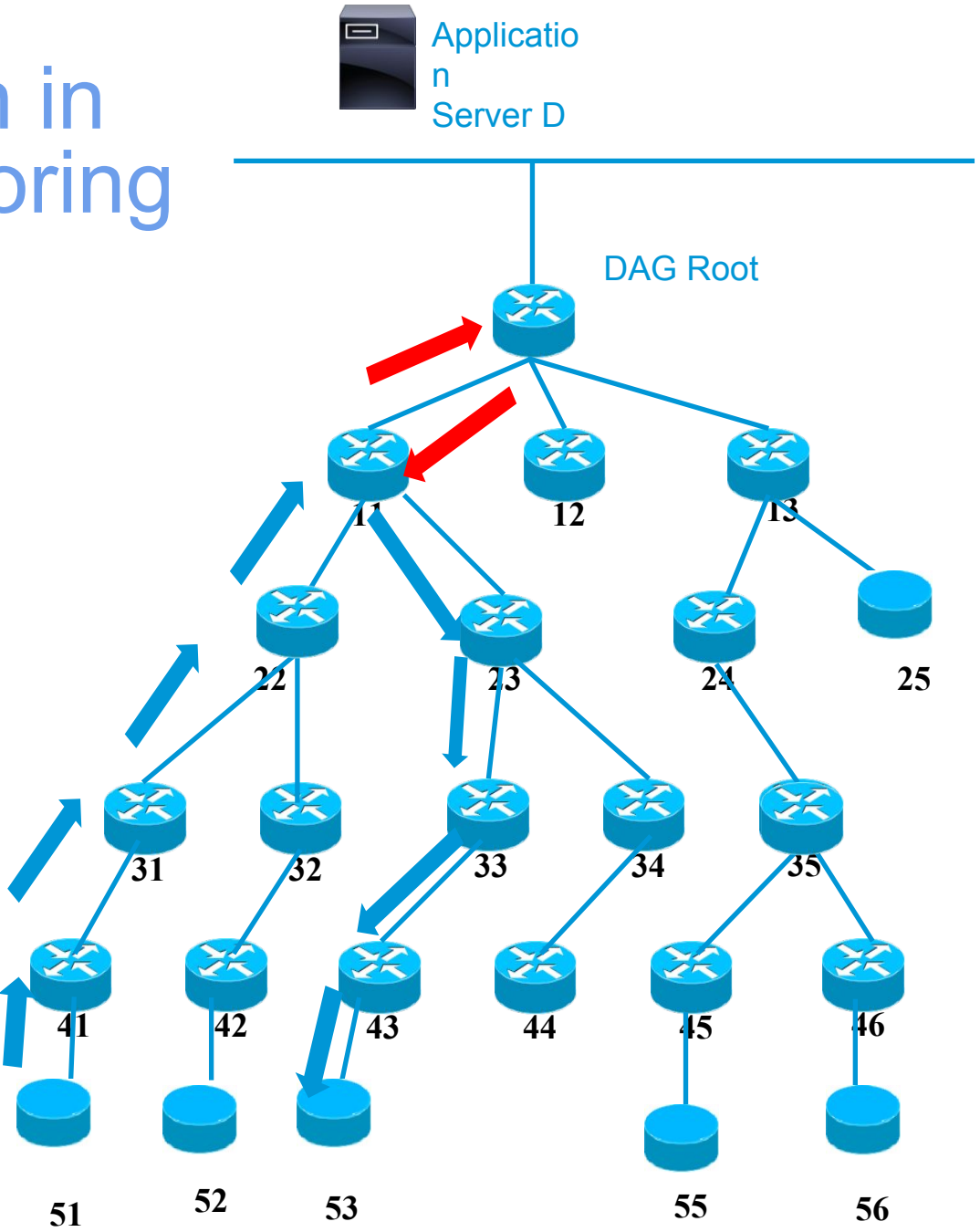
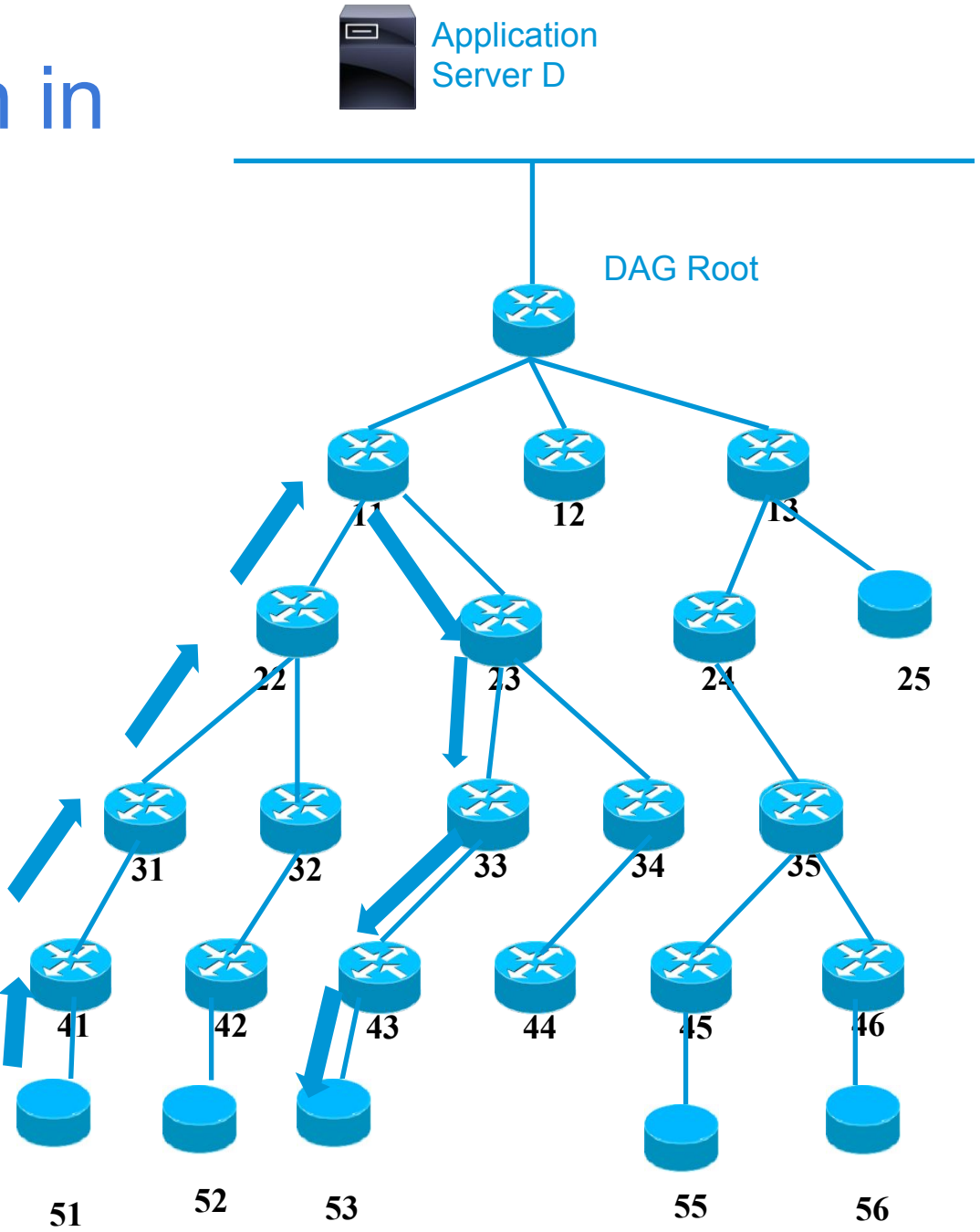
Stretch in non-storing mode



Stretch in storing mode



DAO projection

Application Server D

DAG Root

New (projected) DAO with path segment unicast to target 53 via 41 (ingress), 42 and 43 (egress)

11 12 13

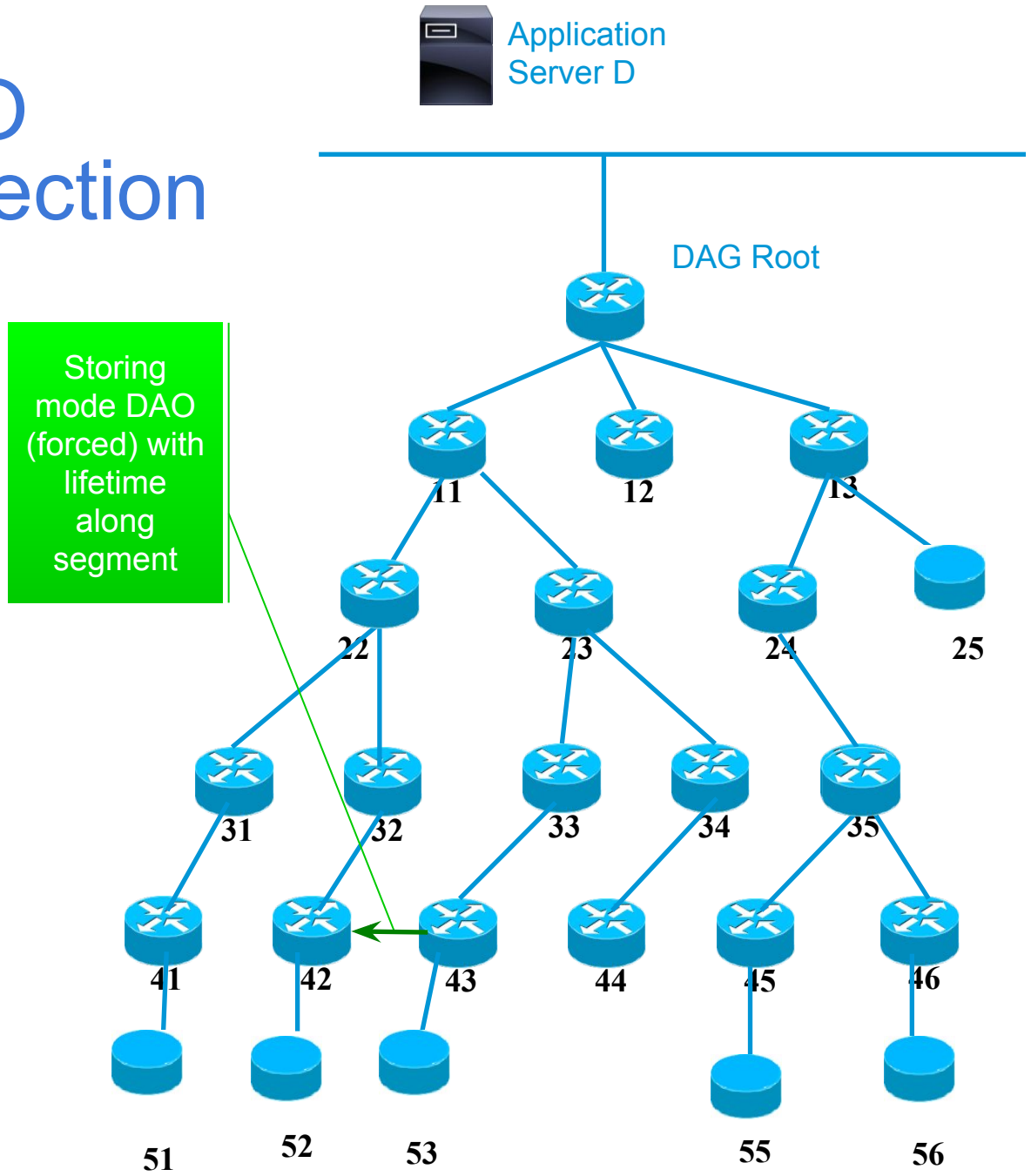
22 23 24 25

31 32 33 34 35

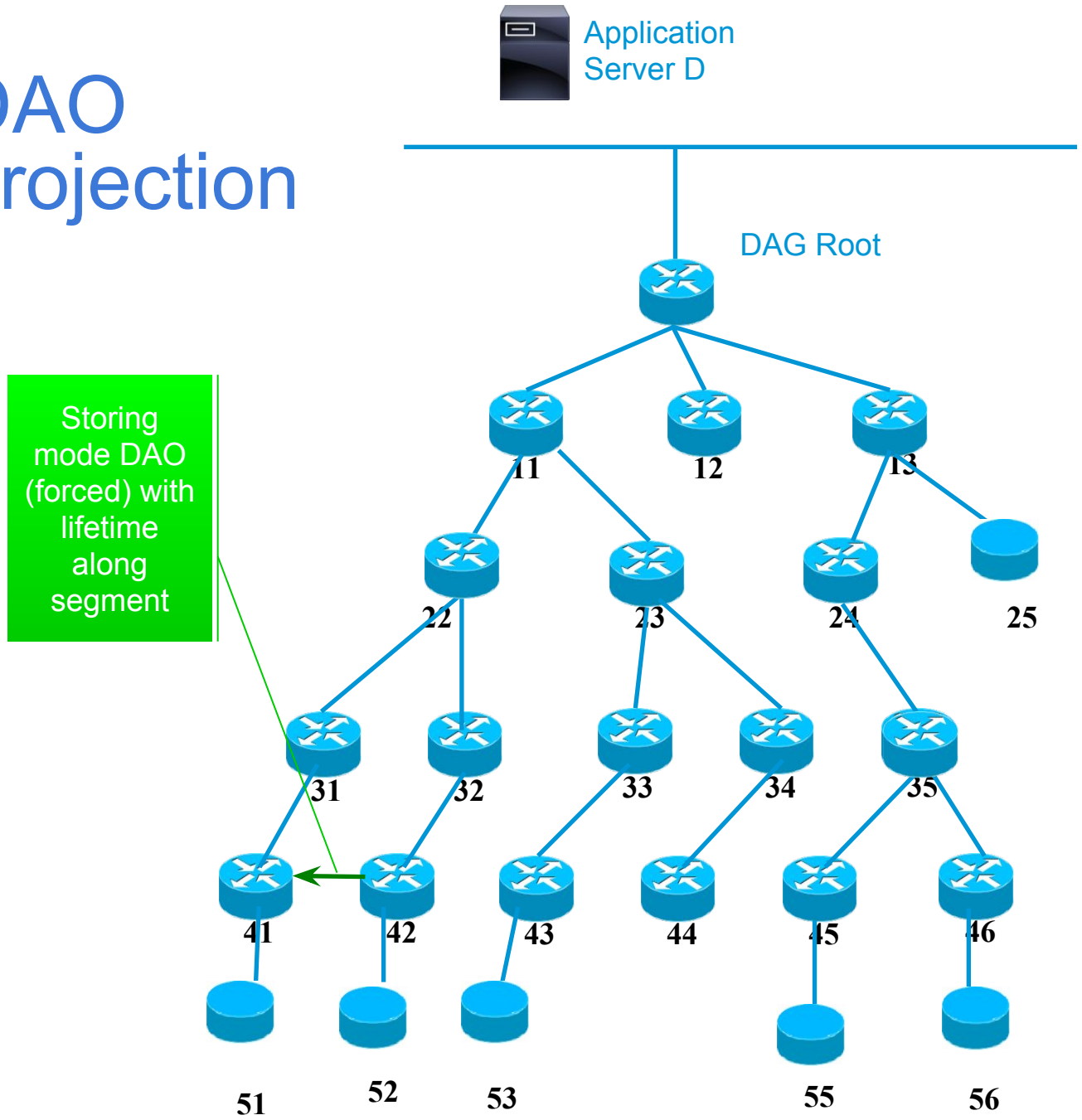
41 42 43 44 45 46

51 52 53 55 56

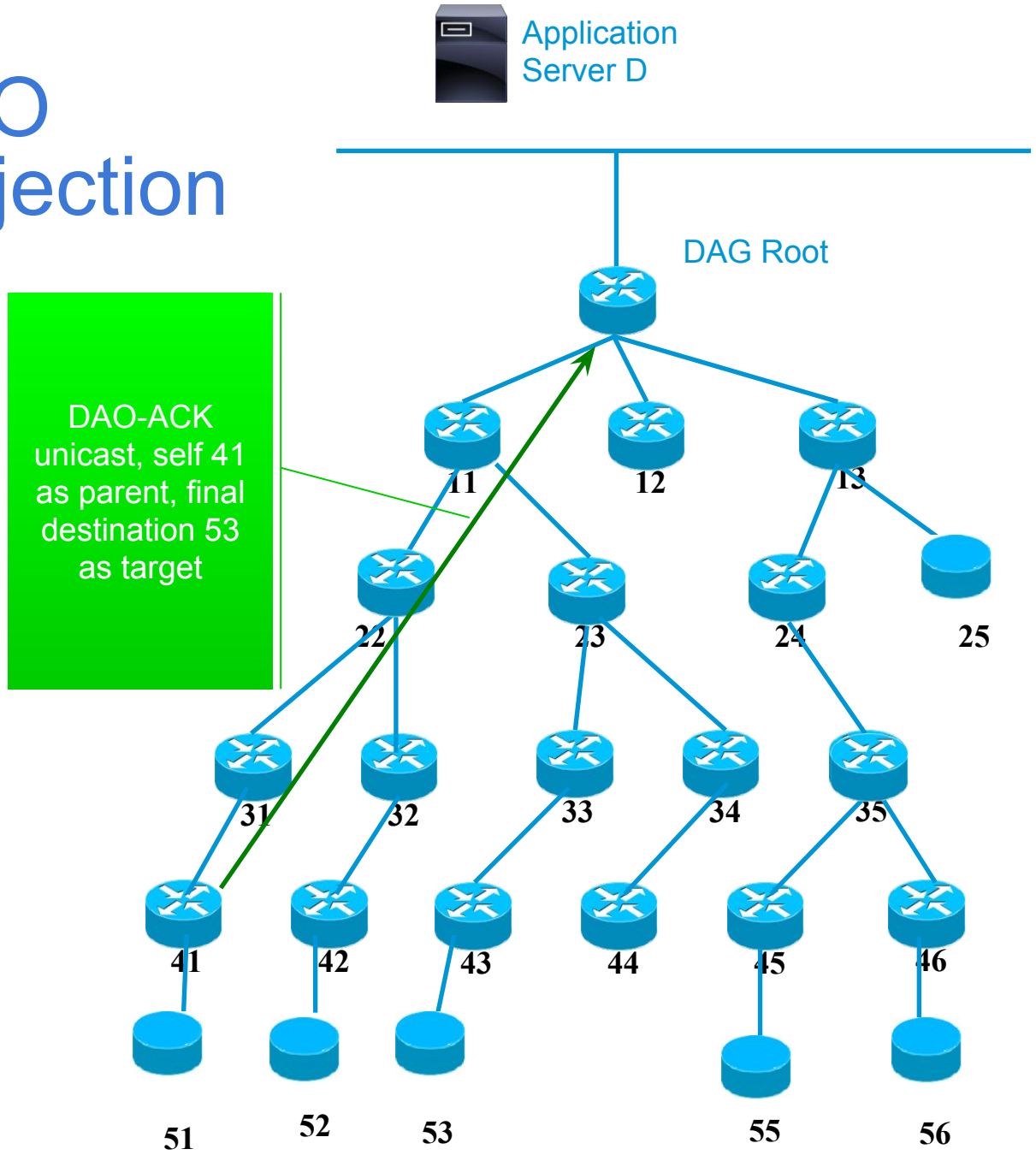
DAO projection



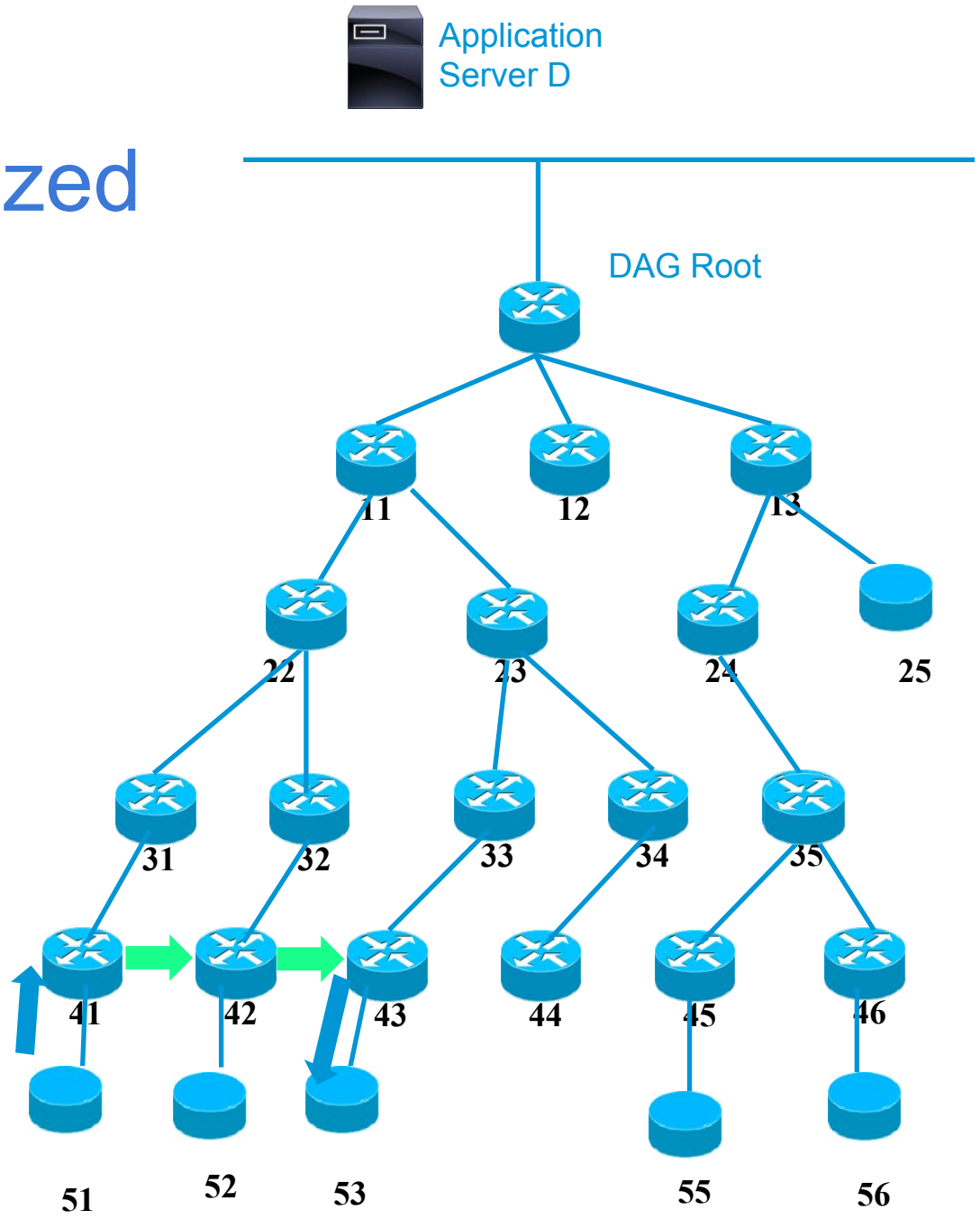
DAO projection



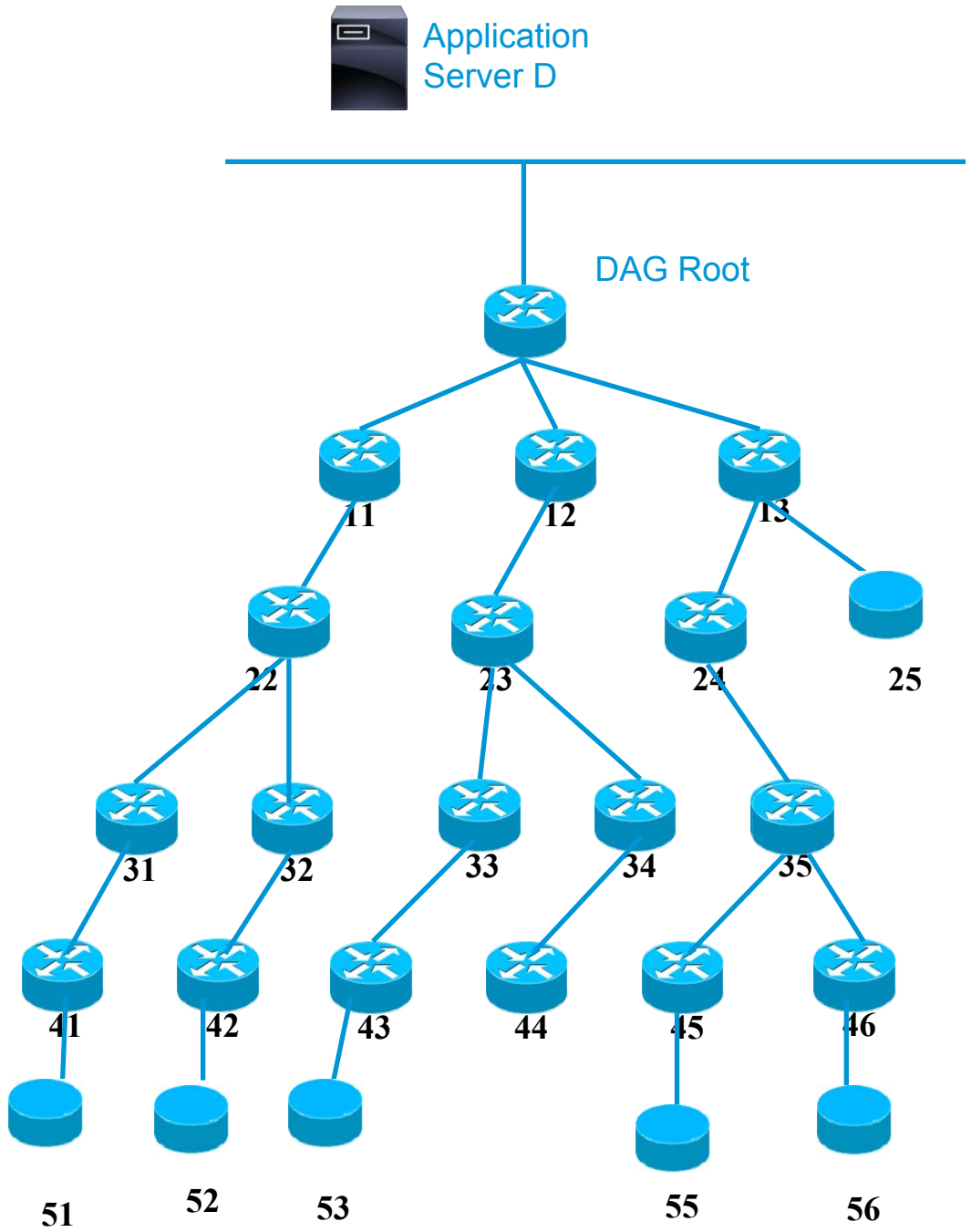
DAO projection



Optimized Path



Existing non storing optimization


Application
Server D
DAG Root
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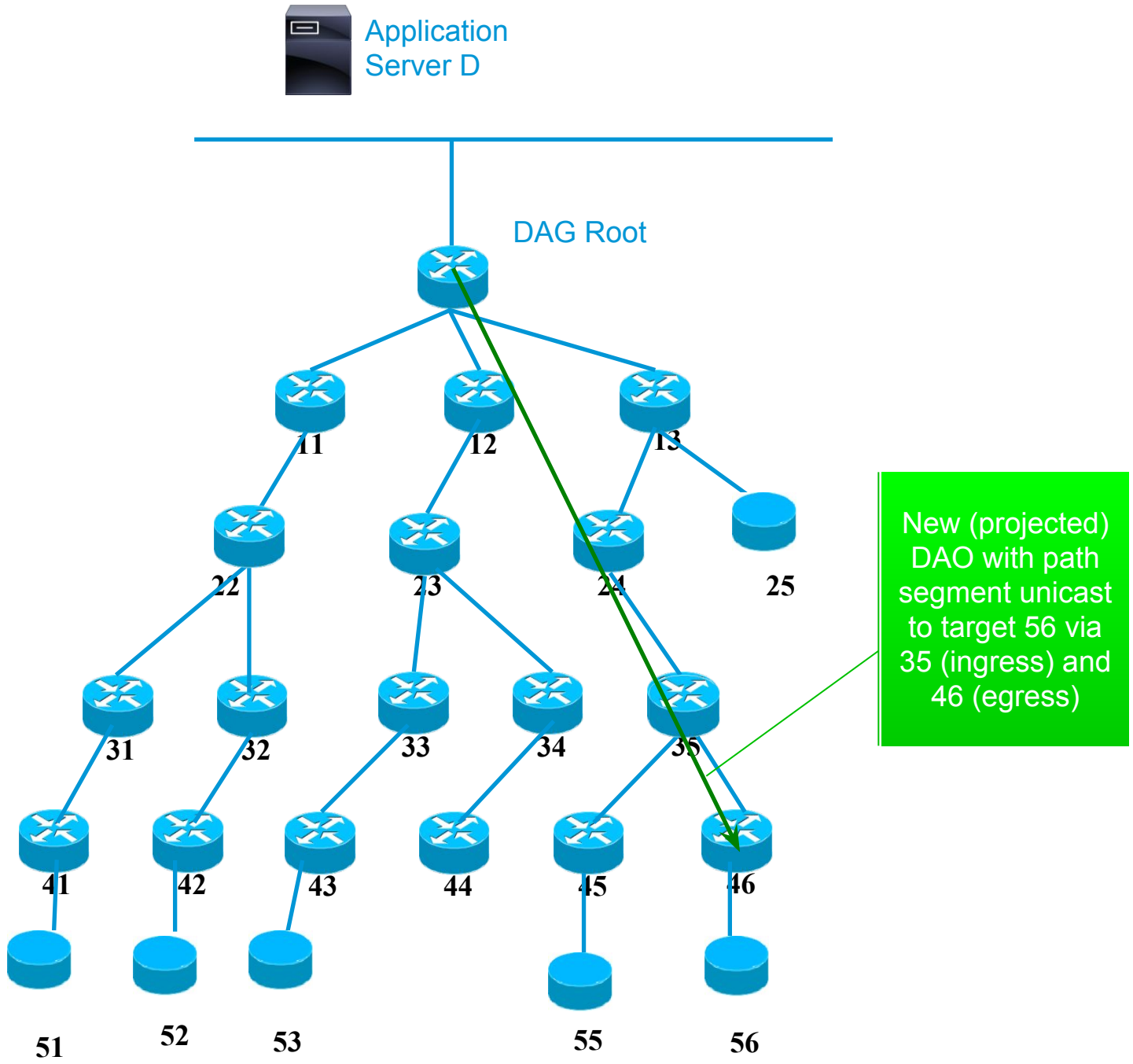
Application
Server D
DAG Root
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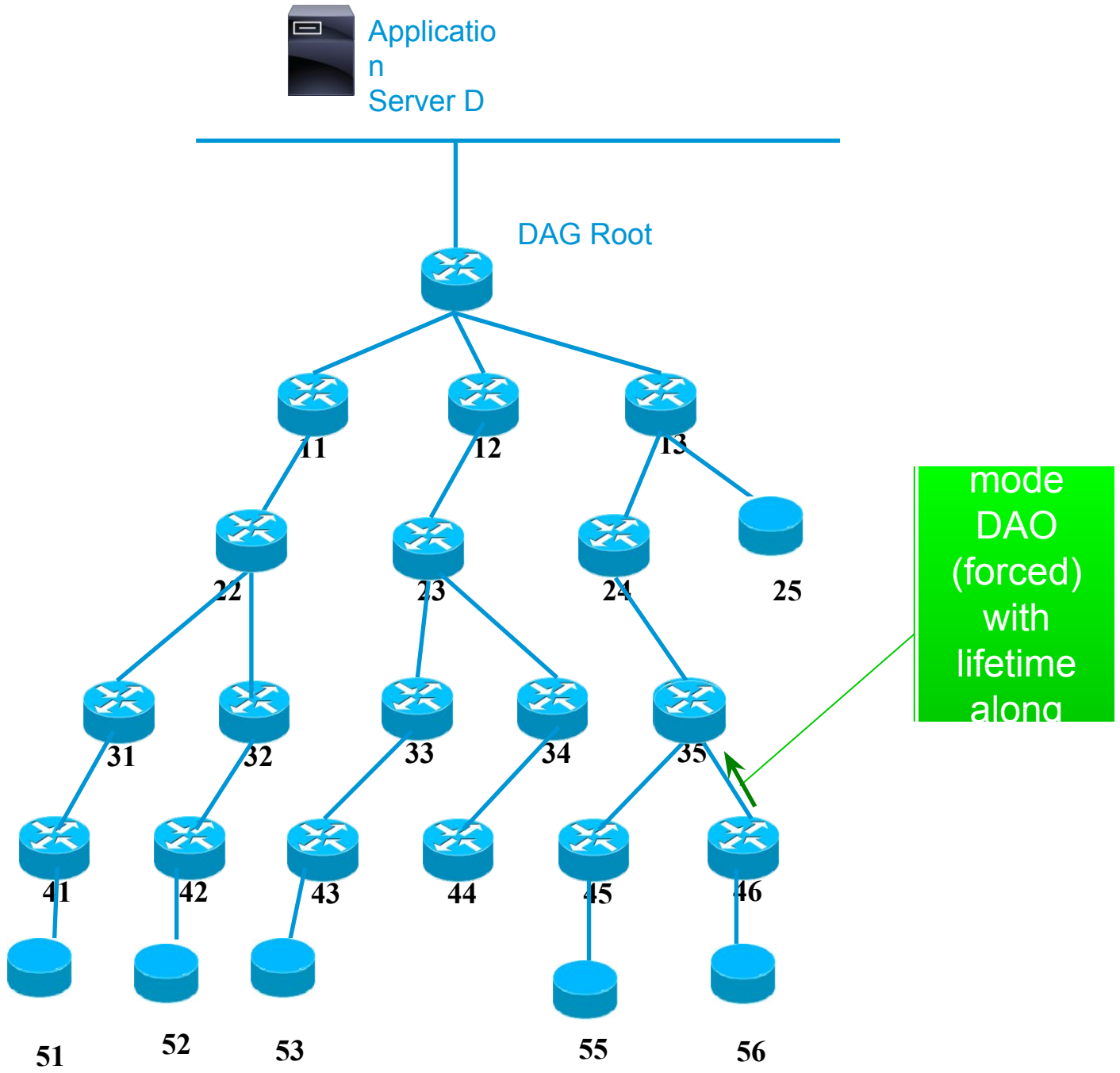
56
New (projected) DAO with path segment unicast to target 56 via 35 (ingress) and 46 (egress)


Applicatio
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Server D
DAG Root
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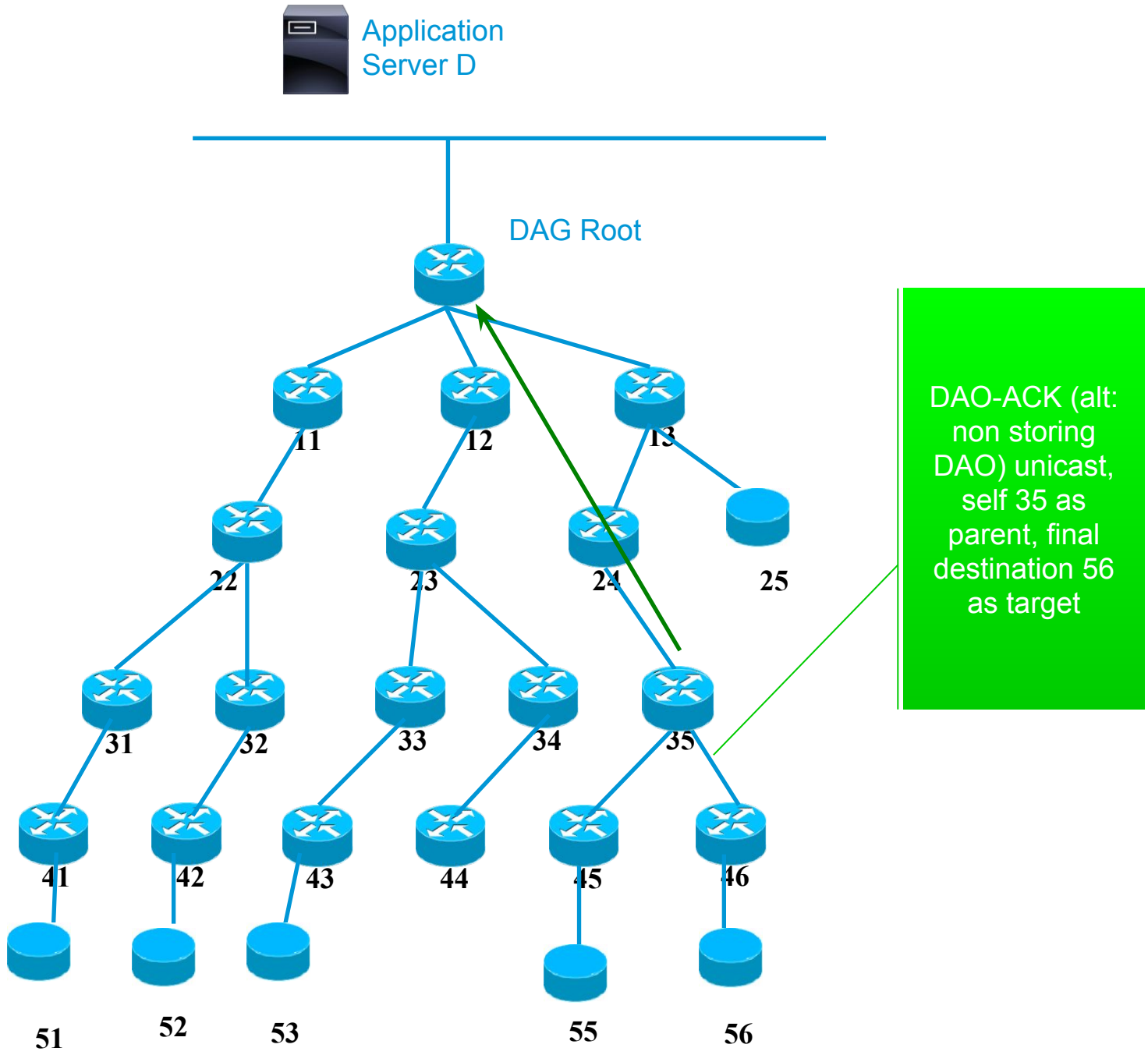
mode
DAO
(forced)
with
lifetime
along


Application
Server D
DAG Root
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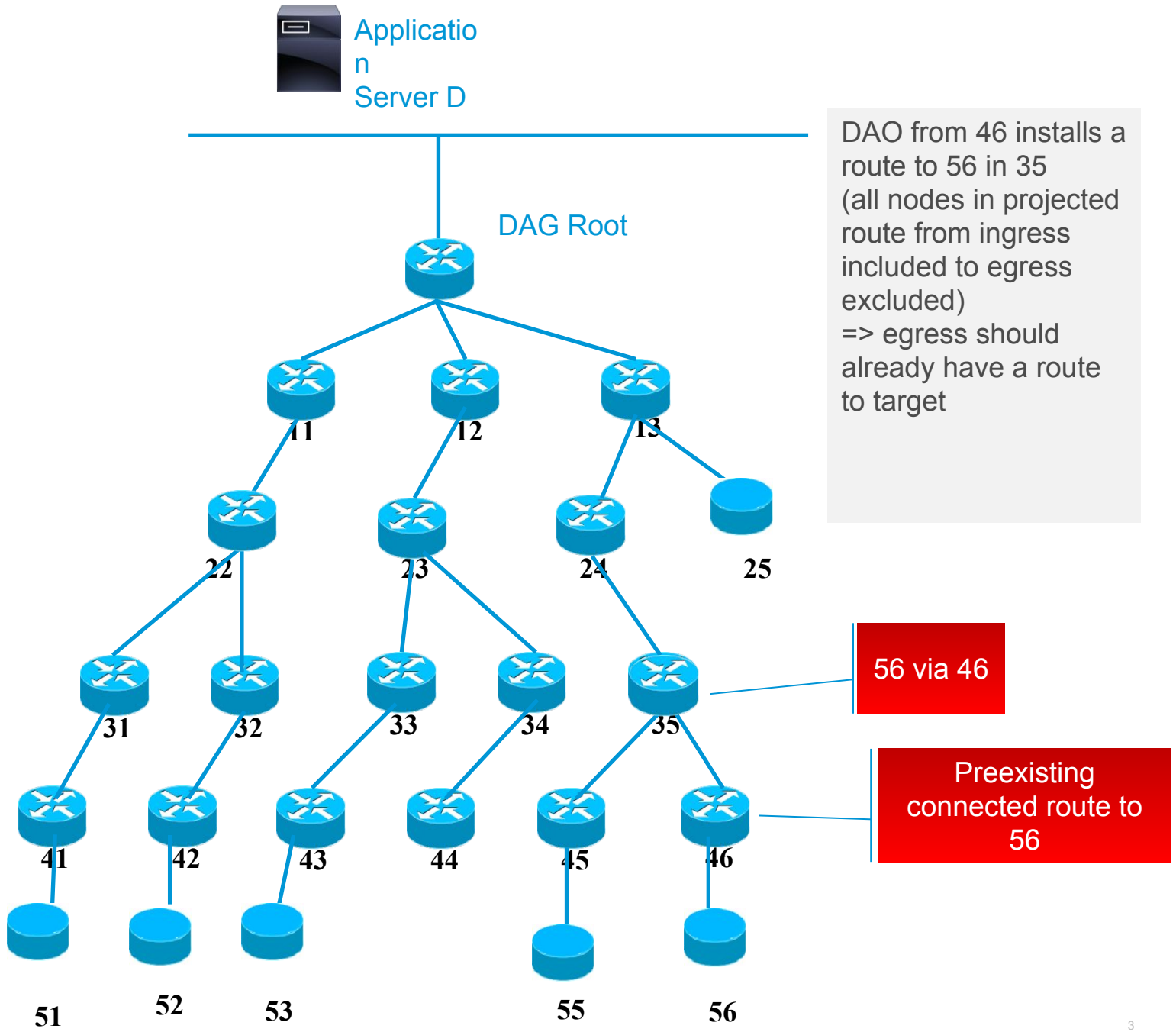
56
DAO-ACK (alt: non storing DAO) unicast, self 35 as parent, final destination 56 as target


Application Server D
DAG Root
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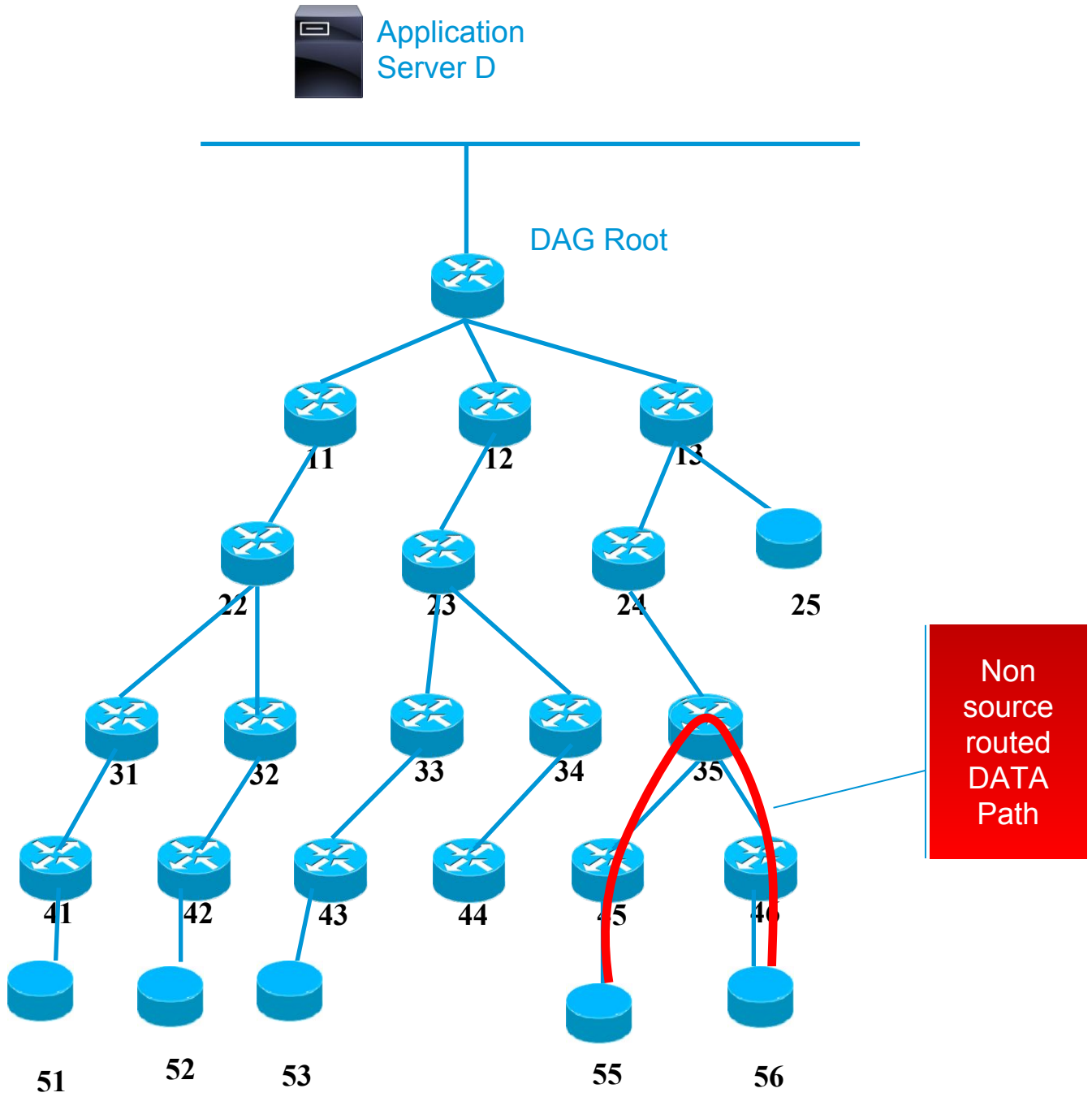
53
55
56
DAO from 46 installs a route to 56 in 35 (all nodes in projected route from ingress included to egress excluded)
=> egress should already have a route to target
56 via 46
Preexisting connected route to 56


Application
Server D
DAG Root
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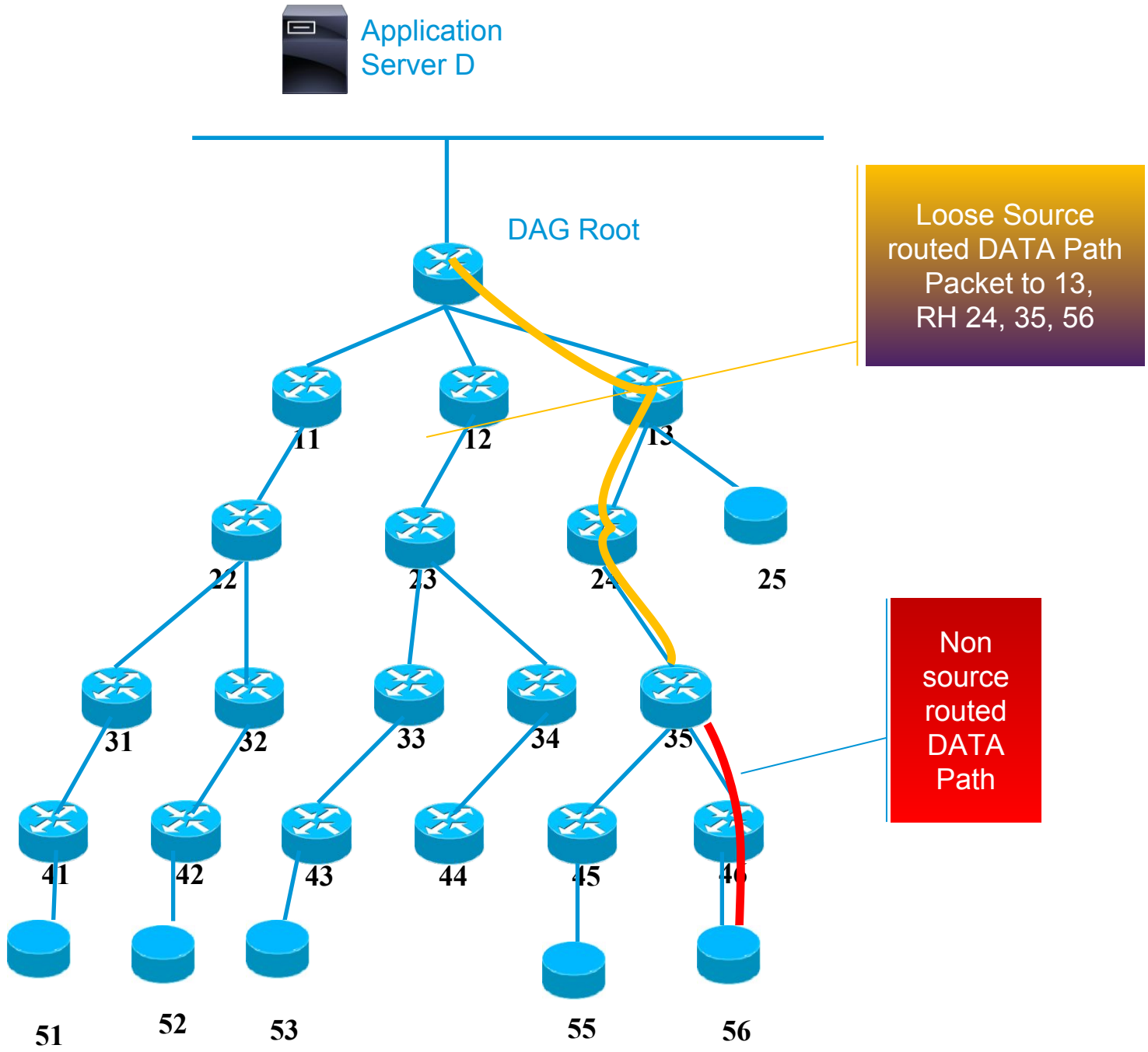
56
Non source routed DATA Path


Application
Server D
DAG Root
Loose Source routed DATA Path Packet to 13, RH 24, 35, 56
Non source routed DATA Path
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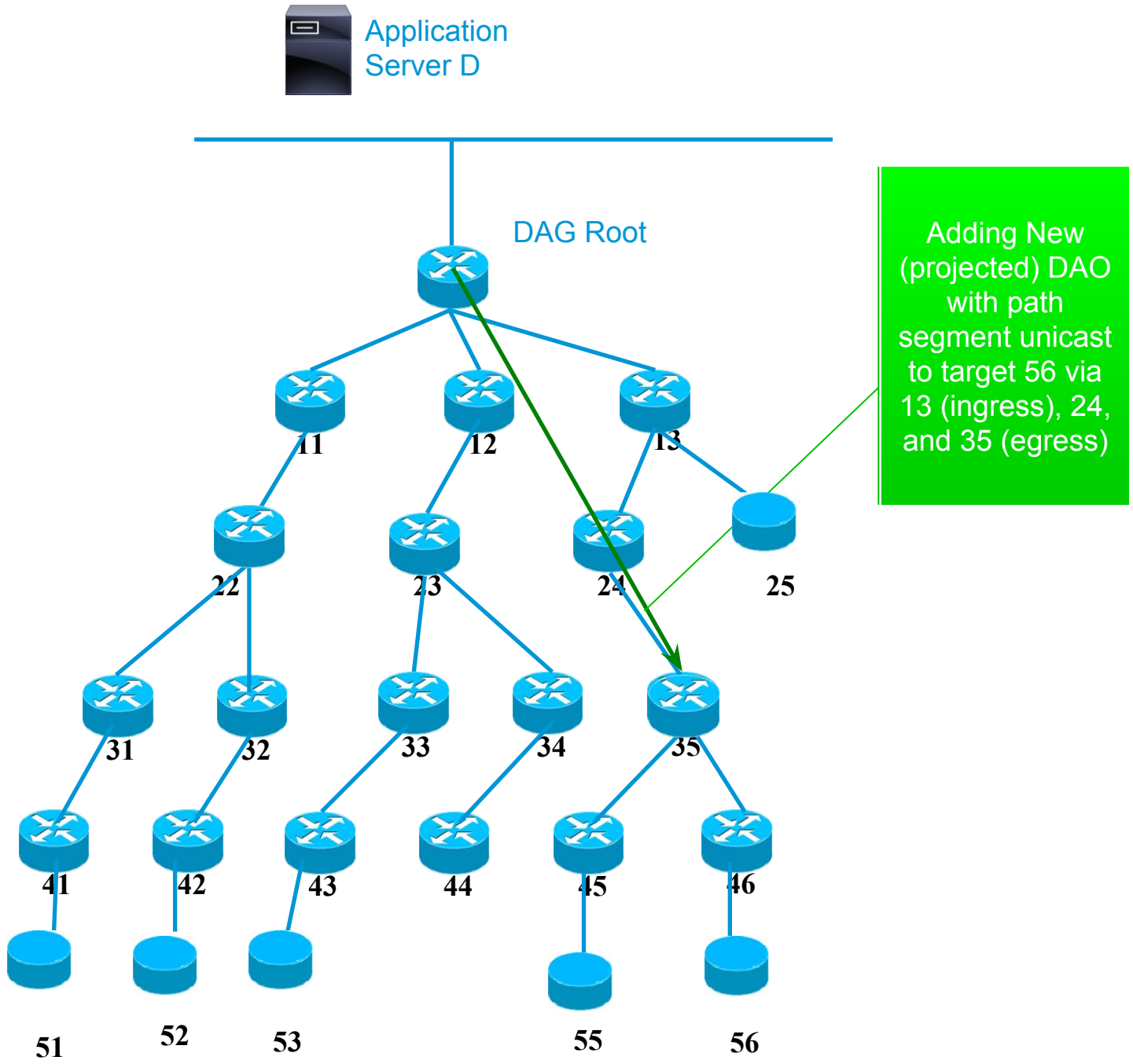
Application
Server D
DAG Root
Adding New (projected) DAO with path segment unicast to target 56 via 13 (ingress), 24, and 35 (egress)
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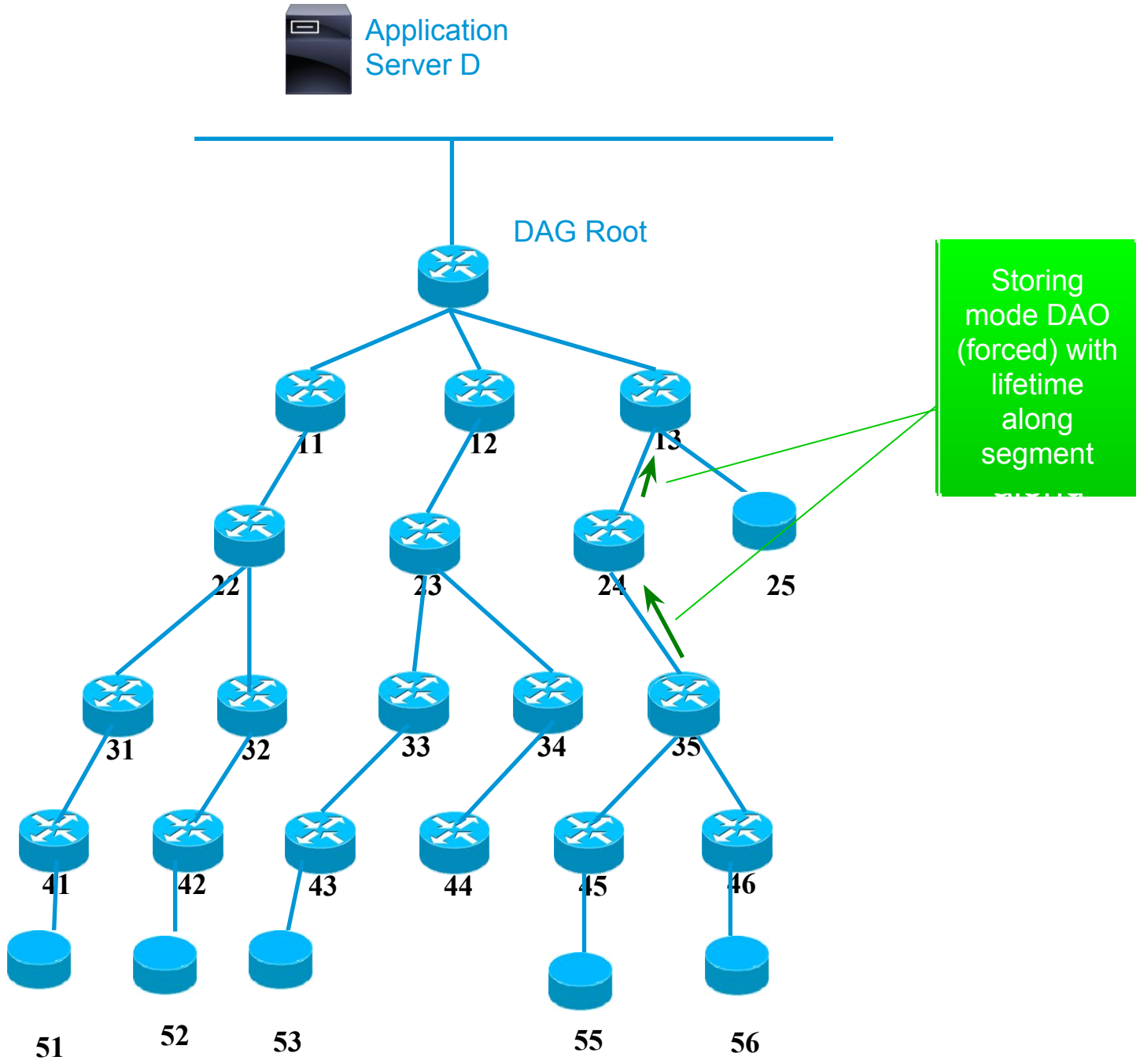
Application
Server D
DAG Root
Storing
mode DAO
(forced) with
lifetime
along
segment
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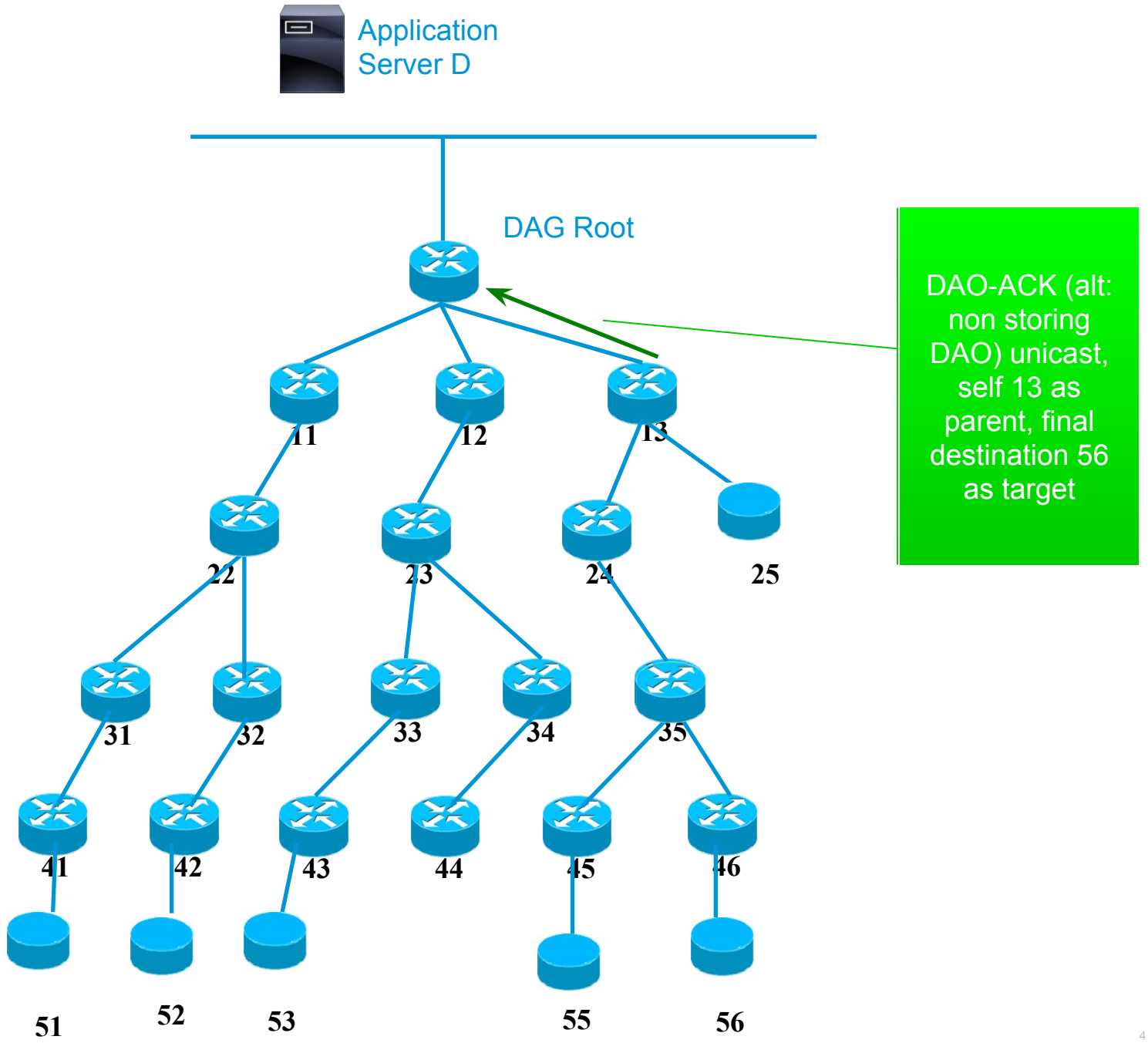
Application
Server D
DAG Root
DAO-ACK (alt: non storing DAO) unicast, self 13 as parent, final destination 56 as target
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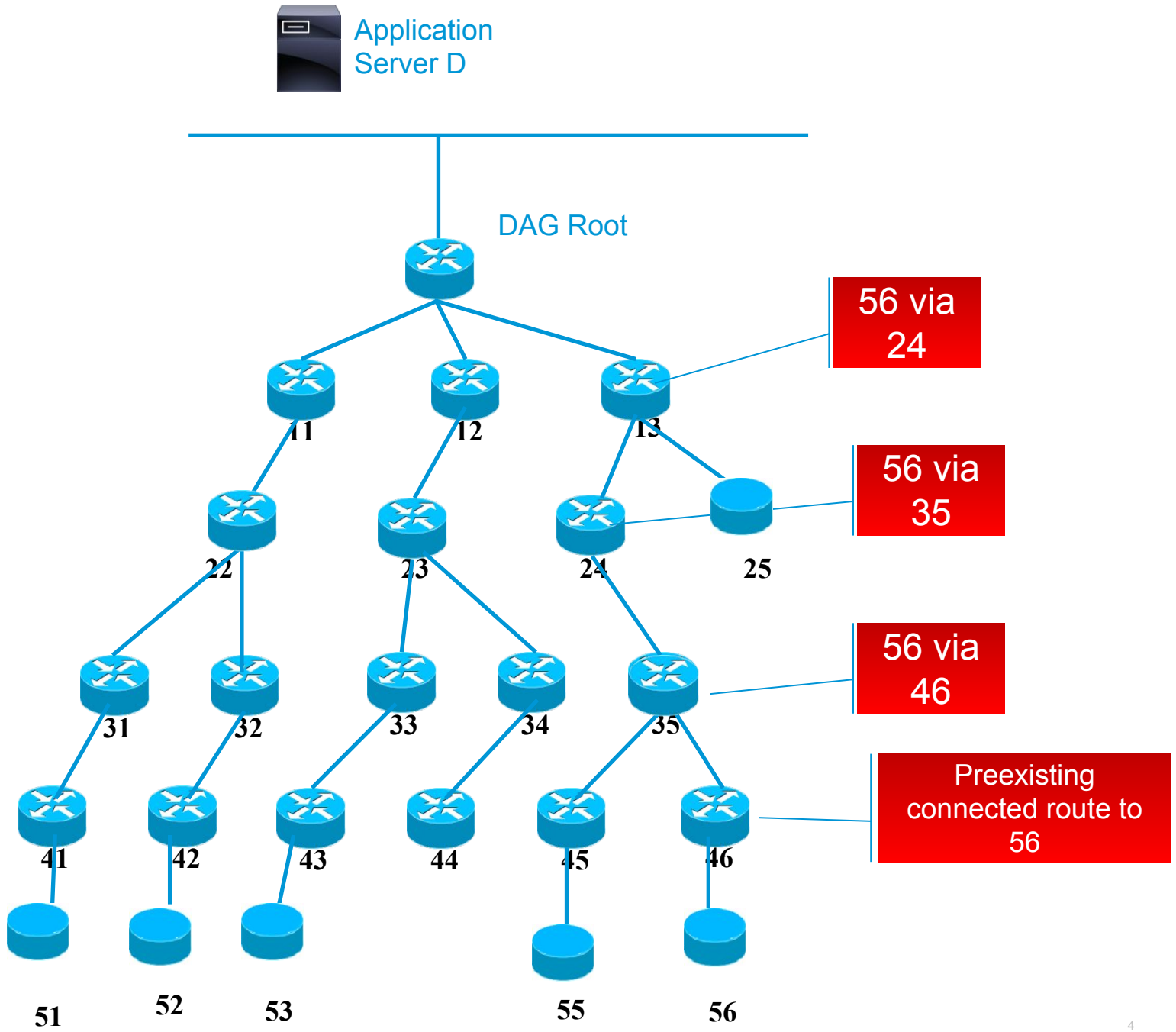
Application
Server D
DAG Root
56 via
24
56 via
35
56 via
46
Preexisting
connected route to
56
11
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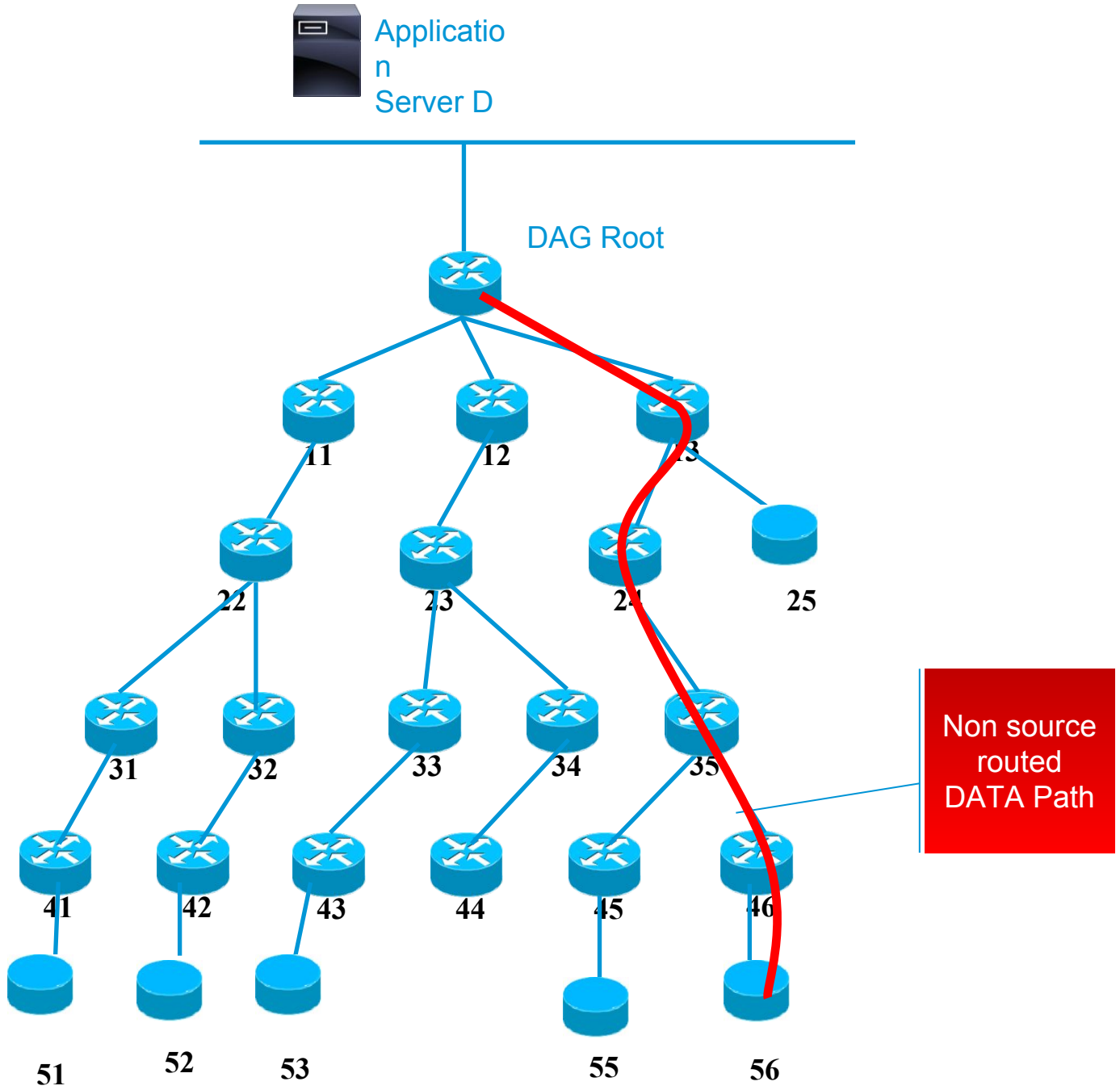
Applicatio
n
Server D
DAG Root
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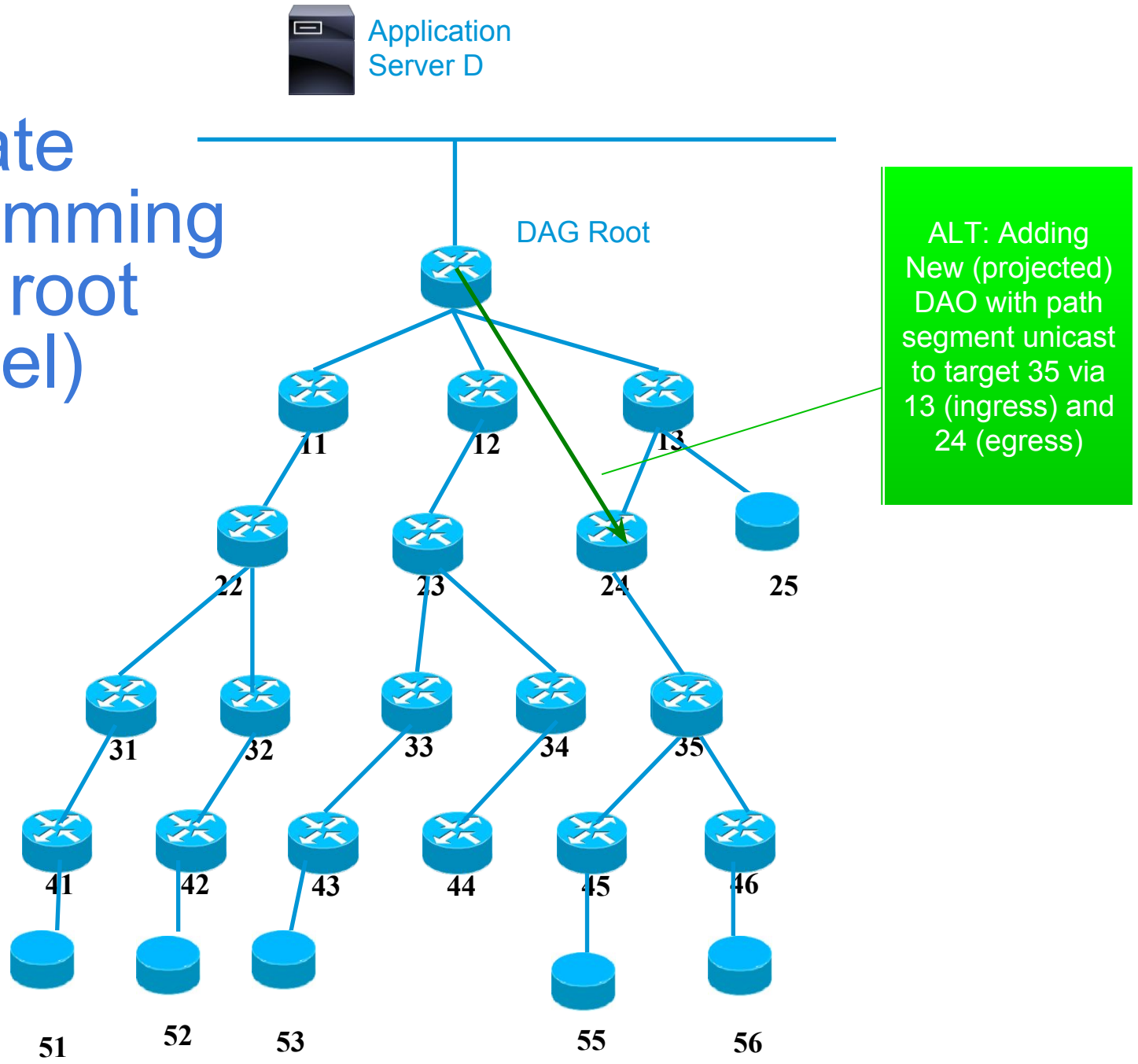
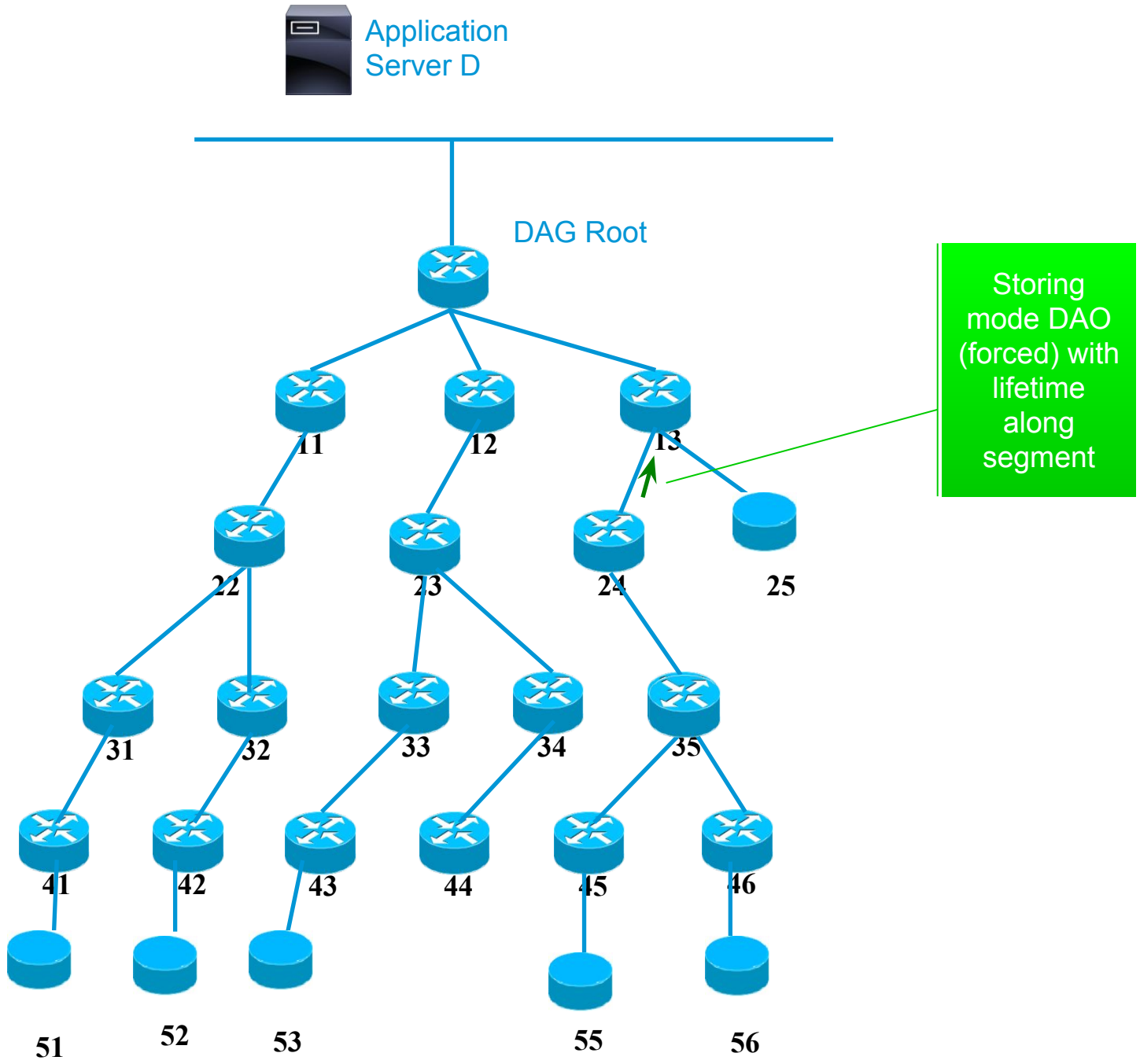
Non source
routed
DATA Path

Alternate Programming By the root (Michael)




Application
Server D
DAG Root
Storing mode DAO (forced) with lifetime along segment
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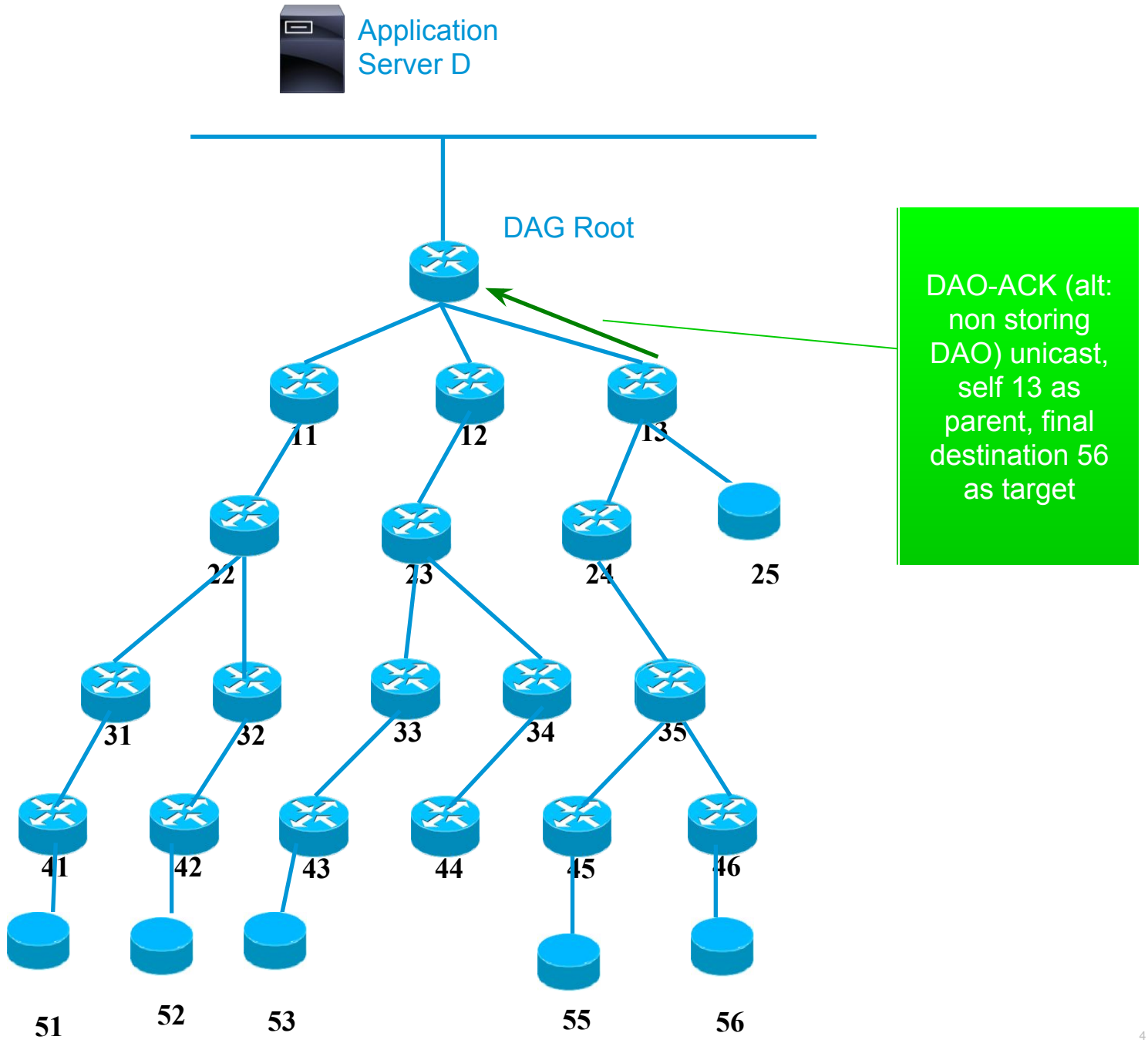
Application
Server D
DAG Root
DAO-ACK (alt: non storing DAO) unicast, self 13 as parent, final destination 56 as target
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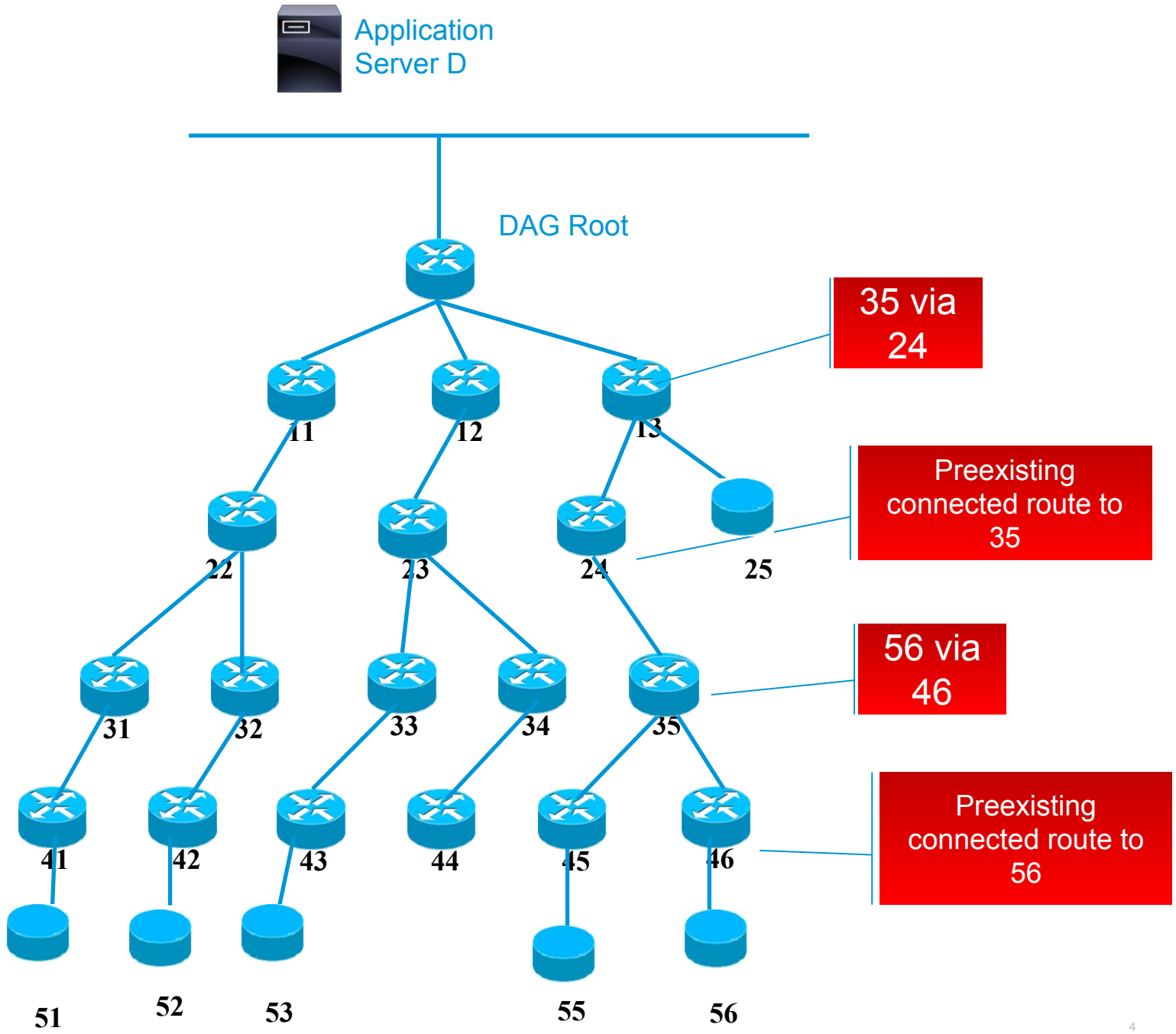
Application
Server D
DAG Root
11
12
13
22
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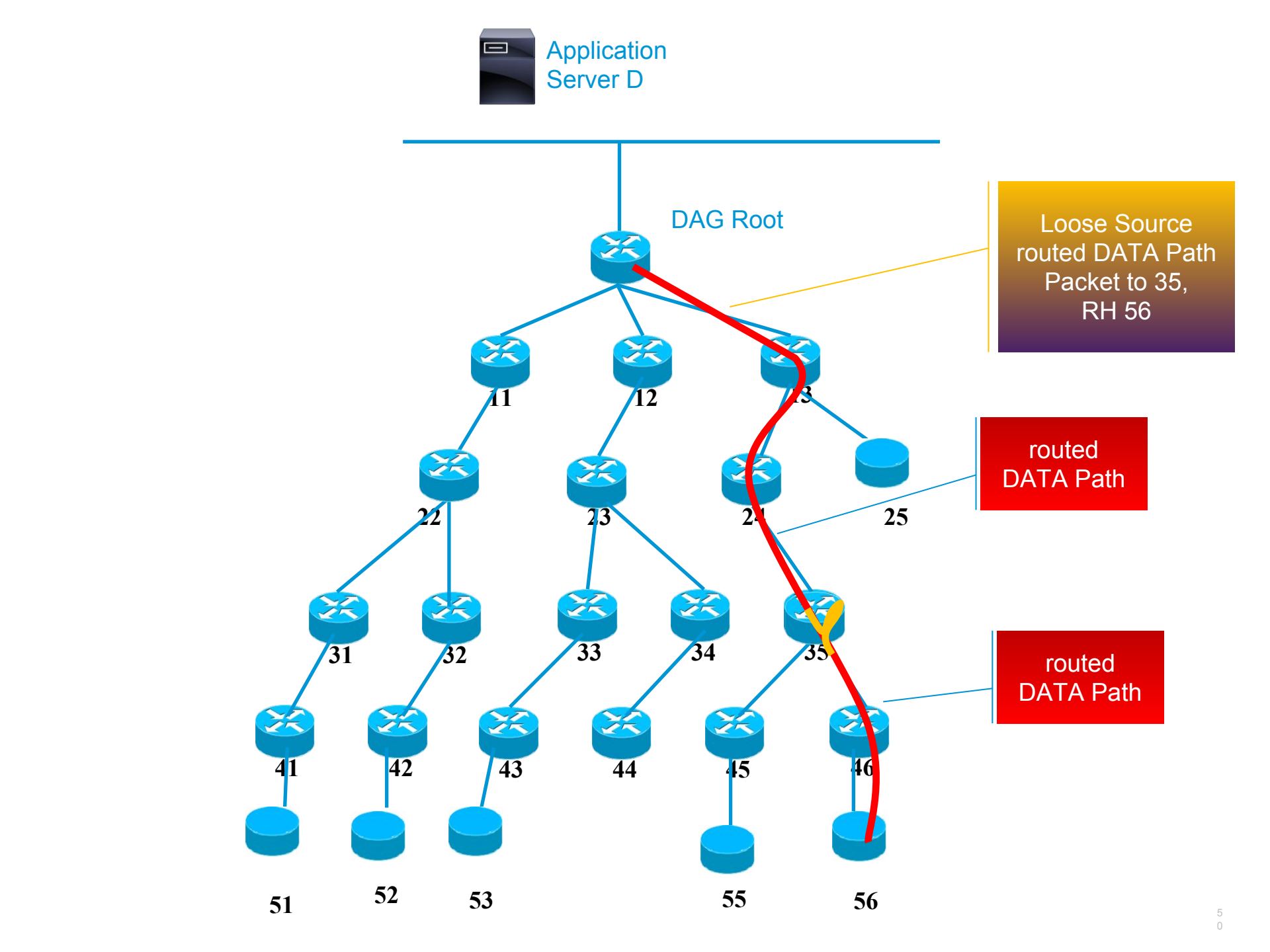
35 via
24
Preexisting
connected route to
35
56 via
46
Preexisting
connected route to
56


Application
Server D
DAG Root
Loose Source routed DATA Path Packet to 35, RH 56
routed DATA Path
routed DATA Path
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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?

Arigatou!

A&Q