IETF 115 ROLL Session

8 November 2022

Chairs: Dominique Barthel, Ines Robles

Secretary: Michael Richardson

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IETF 115 London
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- BCP 25 (Anti-Harassment Procedures)
- BCP 54 (Code of Conduct)
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This session is being recorded

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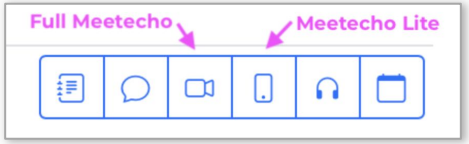

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- Agenda
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- Meetecho and other information:
  https://www.ietf.org/how/meetings/115/preparation
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  http://www.ietf.org/how/meetings/issues/

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- **Remote Participation**
  - Meetecho: https://wws.conf.meetecho.com/conference/?group=roll
  - Material: CodiMD: https://notes.ietf.org/notes-ietf-115-roll
  - Zulip Chat: https://zulip.ietf.org/#narrow/stream/roll
  - Minute takers: **Please volunteer, thank you :)**
  - Datatracker login required to be able to edit the minutes

Agenda

Tuesday, November 8th, 2022

15:00 - 16:00 (UTC) - Tuesday Session III

Time (UTC)	Duration	Draft/Topic	Presenter
15:00 - 15:10	10 min	WG Status	Ines/Dominique
15:10 - 15:25	15 min	more details on documents status: NSA, AODV-RPL, Enrollment-Priority, MOPEX, RNFD	Ines/Dominique
15:25 - 15:40	15 min	draft-ietf-roll-dao-projection	Pascal
15:40- 15:55	15 min	draft-ietf-6lo-multicast-registration	Pascal
15:55 - 16:00	5 min	Open Floor	Everyone

Draft status

Common Ancestor Objective Function and Parent Set DAG Metric Container Extension draft-ietf-roll-nsa-extension-10	AD evaluation, revised I-D needed
Supporting Asymmetric Links in Low Power Networks: AODV-RPL draft-ietf-roll-aodv-rpl-14	New version addressing open issues
Root initiated routing state in RPL draft-ietf-roll-dao-projection-27	WGLC'ed, discussed today
Controlling Secure Network Enrollment in RPL Networks draft-ietf-roll-enrollment-priority-06	Addressing Open Issues
Mode of Operation extension draft-ietf-roll-mopex-04	waiting for attention
RPL Capabilities draft-ietf-roll-capabilities-09	waiting for attention
RNFD: Fast border router crash detection in RPL draft-ietf-roll-rnfd-00	New Work adopted by the WG, review/discussion needed
RPL Storing Root-ACK draft-jadhav-roll-storing-rootack-03	WG adoption to be called

Milestones

Milestones

Date	Milestone
Nov 2023	Initial submission of Fast Border Router Crash Detection in RPL to the IESG
Nov 2023	Recharter WG or close
Nov 2023	Initial submission of a proposal to augment DIS flags and options to the IESG
Nov 2023	Initial submission of a proposal for Source-Route Multicast for RPL to the IESG
Nov 2023	Initial submission of a YANG model for MPL to the IESG
Jun 2023	Initial submission of Capabilities for RPL to the IESG
Nov 2022	Initial submission of Mode of Operation extension for RPL to the IESG
Sep 2022	Initial submission of Controlling Secure Network Enrollment in RPL networks draft to the IESG
May 2022	Initial submission of a root initiated routing state in RPL to the IESG

Done milestones

Date	Milestone
Done	Initial submission to the IESG of mechanism to turn on RFC8138 compression feature within a RPL network
Done	Initial submission of Common Ancestor Objective Functions and Parent Set DAG Metric Container Extension to the IESG
Done	Initial submission of routing for RPL Leaves draft to the IESG
Done	Initial submission of a reactive P2P route discovery mechanism based on AODV-RPL protocol to the IESG
Done	Initial Submission of a proposal with uses cases for RPI, RH3 and IPv6-in-IPv6 encapsulation to the IESG
Done	Initial submission of a solution to the problems due to the use of No-Path DAO Messages to the IESG

more details on documents status

NSA-extension

Common Ancestor Objective Function and Parent Set DAG Metric Container Extension

- AD review March 17th
  - motivation: is this work usable beyond Packet Replication and Elimination?
  - about 40 comments, 20 noted as “major”
- being addressed by the authors
- Revised draft needed before sending to IESG

AODV-RPL

Supporting Asymmetric Links in Low Power Networks - Reactive P2P route discovery for hop-by-hop and source routing

- Introduces AODV-RPL DIO Options:
  - AODV-RPL RREQ (Route Request) Option
    - Present in DIO Messages from OrigNode toward TargNode
  - AODV-RPL RREP (Route Reply) Option
    - Present in DIO Messages from TargNode toward OrigNode
  - AODV-RPL Target (ART) Option
    - Present in RREQ DIO and RREP DIO messages
- Introduces a new multicast address with link-local scope: all-AODV-RPL-nodes
- MOP = 4
  - Does not collide with P2P-RPL (RFC6997)
    - They will operate as different RPL Instances

AODV-RPL

https://mailarchive.ietf.org/arch/msg/roll/dX4hMiwl4biCqF_97MwcnxvqEg4/

6.3.3. RPLInstanceID Pairing

Since the RPLInstanceID is assigned locally (i.e., there is no coordination between routers in the assignment of RPLInstanceID), the tuple (OrigNode, TargNode, RPLInstanceID) is needed to uniquely identify a discovered route. It is possible that multiple route discoveries with dissimilar Objective Functions are initiated simultaneously. Thus between the same pair of OrigNode and TargNode, there can be multiple AODV-RPL route discovery instances. So that OrigNode and Targnode can avoid any mismatch, they MUST pair the RREQ-Instance and the RREP-Instance in the same route discovery by using the RPLInstanceID.

AODV-RPL

- New version 15 published on Sept. 30th
  - Address ticket 1 (https://github.com/roll-wg/aodv-rpl/issues/1)
    - John Scudder discuss: comments to improve readability
  - Address ticket 2 (https://github.com/roll-wg/aodv-rpl/issues/2)
    - Ben Kaduk discuss: comments to improve the protocol
  - Address ticket 3? (https://github.com/roll-wg/aodv-rpl/issues/3)
    - Pascal review.
    - Last comments on ML in July
  - Review by Konrad, Last comments on ML in Oct
- Next Step: Last Call when all issues closed

Enrollment-priority
Controlling Secure Network Enrollment in RPL Networks

Ticket	Description
4	Enrollment priority option name
5	Explain how new option values are related to DODAGVersionNumber
7	-05 Section 3.1, questions
10	Should priority have more than 1 bit: join disabled/enabled?
11	What EB and priority, if any should a node with no feasible parent emit?
12	should root explicitly reset trickle timer?
13	add explicit lollipop counter into enrollment priority option

- Work to be resumed when resource available

MOPEX
Mode of Operation extension

- RPL instance operates in one among multiple possible modes
- We are running out of mode code points
- This draft extends the Mode of Operation field

- Ticket #8: Do-not-join-instance flag in RPL ext control option

  Currently, the MOPex draft extends the RPL control options with certain flags to handle cases where the control option is not understood by the node: J-flag: Join only as 6LN - C-flag: copy option as-is even if not understood - I-flag: Ignore message altogether.
  We could have an option for the node to not join the network at all (not even as 6LN) if a control option is not understood.

- Discussion in ML

RNFD

Fast border router crash detection in RPL - having nodes collaboratively monitoring the status of the root.

- Protocol features:
  - Proposed as extension of RPL
  - Introduces RNFD Option
    - Carried in DIOs and DISs
  - Roles: Acceptor and Sentinel
  - Conflict-Free Replicated Counter (CFRC)
- Presented at last interim meetings: https://notes.ietf.org/s/notes-ietf-interim-2022-roll-01-roll
- version -01 published Oct. 12th

RNFD

Fast border router crash detection in RPL - having nodes collaboratively monitoring the status of the root.

ML Discussion Points:
https://mailarchive.ietf.org/arch/msg/roll/h6UsXpjAYFfDHADHZ8phDgAoj28/

1. What happens when Sentinels (the root's one-hop neighbors that monitor its state) don't hear each other? Does the algorithm still detect the crash of the root?
2. What if most of the direct links to the root fail but the root is in fact alive?
3. Is rebuilding the DODAG in such a case desirable?
4. Why can't Sentinels ask the root whether it is dead?
5. The threshold that describes how large the majority is is configured into the nodes. It is not conveyed as part of the protocol operation. Should it?
6. What is the effect of the parameter being different on different sentinels/acceptors?

- Discussion to be continued on ML
- Reviews/comments needed.

Root initiated routing state in RPL

draft-ietf-roll-dao-projection

Pascal Thubert, Rahul Arvind Jadhav, Michael Richardson

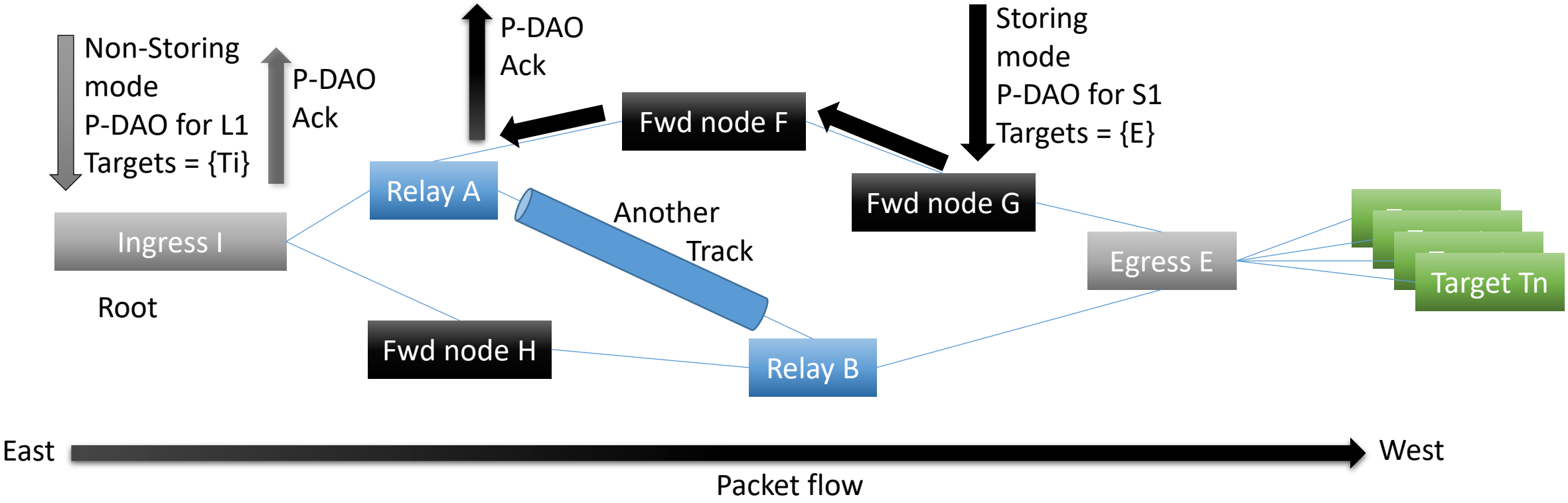
IETF 115, London

Presenter: Pascal Thubert

DAO Projection (Centralized RPL)

- Root connected-to or acting-as controller
  - Uses topological info from main DODAG
  - New Sibling Information Option (and P-DAO request)
  - Uses Projected DAO to install paths in the network
- Builds Segments to compress SHR
  - Compresses selected long paths in main DODAG
  - Uses Storing Mode Projected DAO to install strict (serial) paths
- Builds new DODAGs called Tracks
  - Enables optimized P2P (east – west) routing
  - Uses Non-Storing Mode Projected DAO to install loose (dotted-line) graphs
  - Leveraging Segments to complete the graph

The RPL Track: A DODAG rooted at Ingress



Targets {Tx }

Legs L1 = I->A->E to {Ti} , L2 = I->B->E to {Ti} , L3 = I->A->B->E to {Ti}

Segments S1 = A=>F=>G to E , S2 = I=>H to B

SubTracks Any Set ⊂ {L1, L2, L3} but { }

Draft Status

- WGLC at -26
- All known issues addressed at current (-29)
- Ready for publication

Status of the draft (cont.)

-28 (as promised at IETF 114) refine on WGLC issues:

- Clarify that each instance implies a RIB
- Multi-topology routing loop avoidance rules:
  - neighbor> indirect via common neighbor > Segment > Track
  - Partial order between RPL instances to allow jumping
- Crossing Segments discussion
- Clarifying mcast DAO exposes neighbors in SIOs

Status of the draft (cont.)

-> 29 Clean up:

- Remove duplicated text in intro
- Lower case “main” in “main DODAG”

Next

- Publication request?

DAO Projection

Backup Slides

DAO Projection (Centralized RPL)

- Root connected-to or acting-as controller
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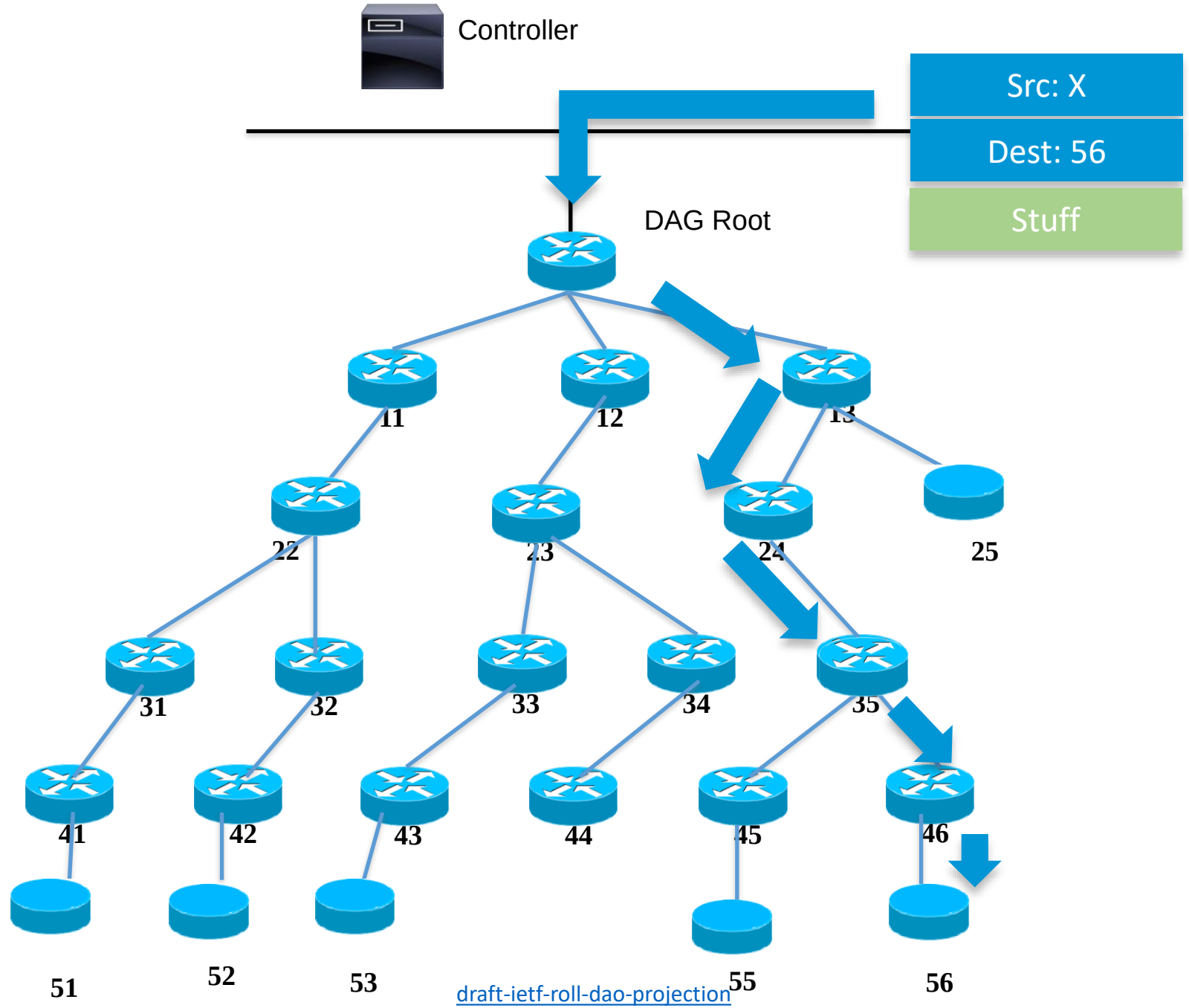
draft-ietf-roll-dao-projection



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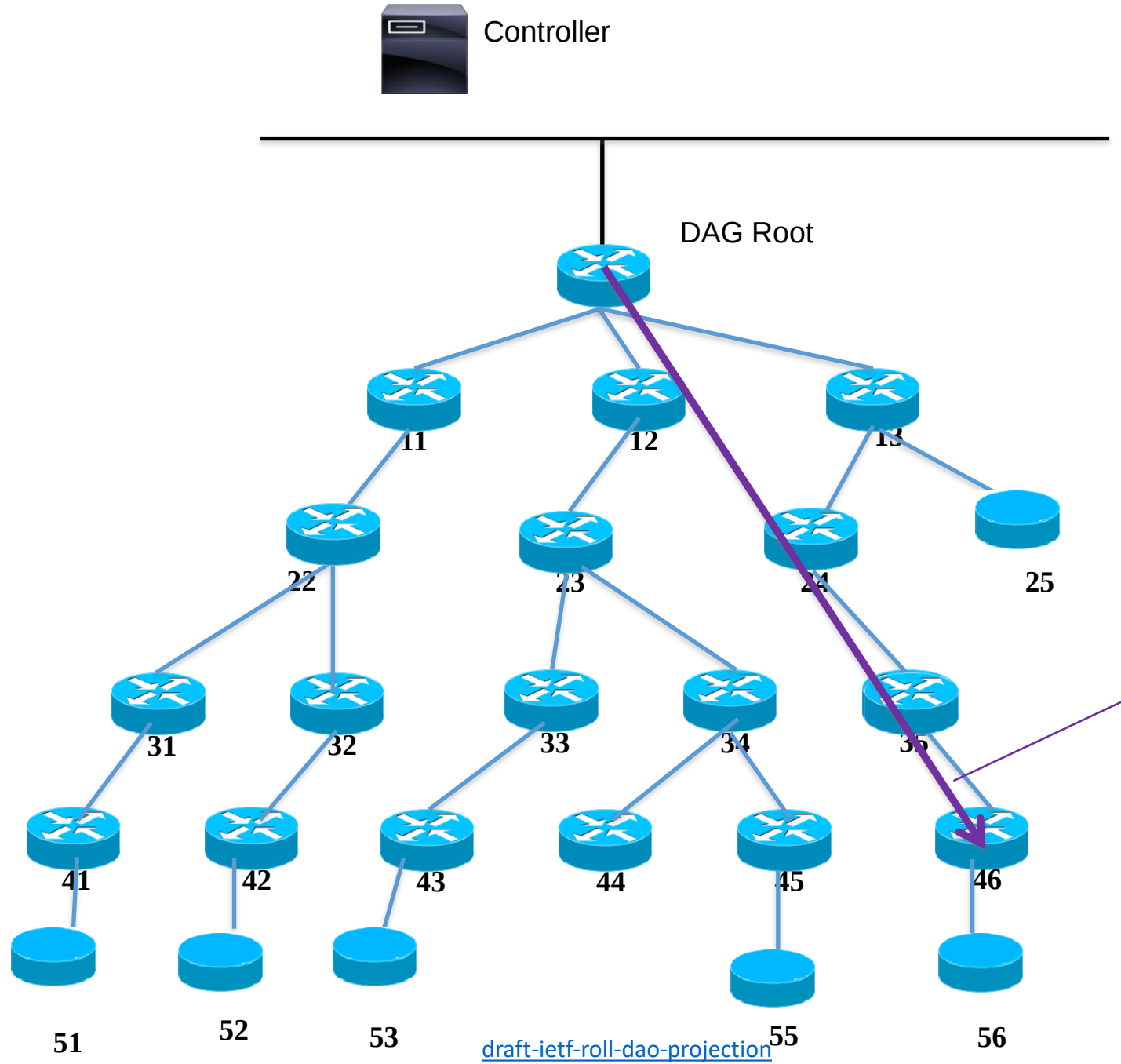
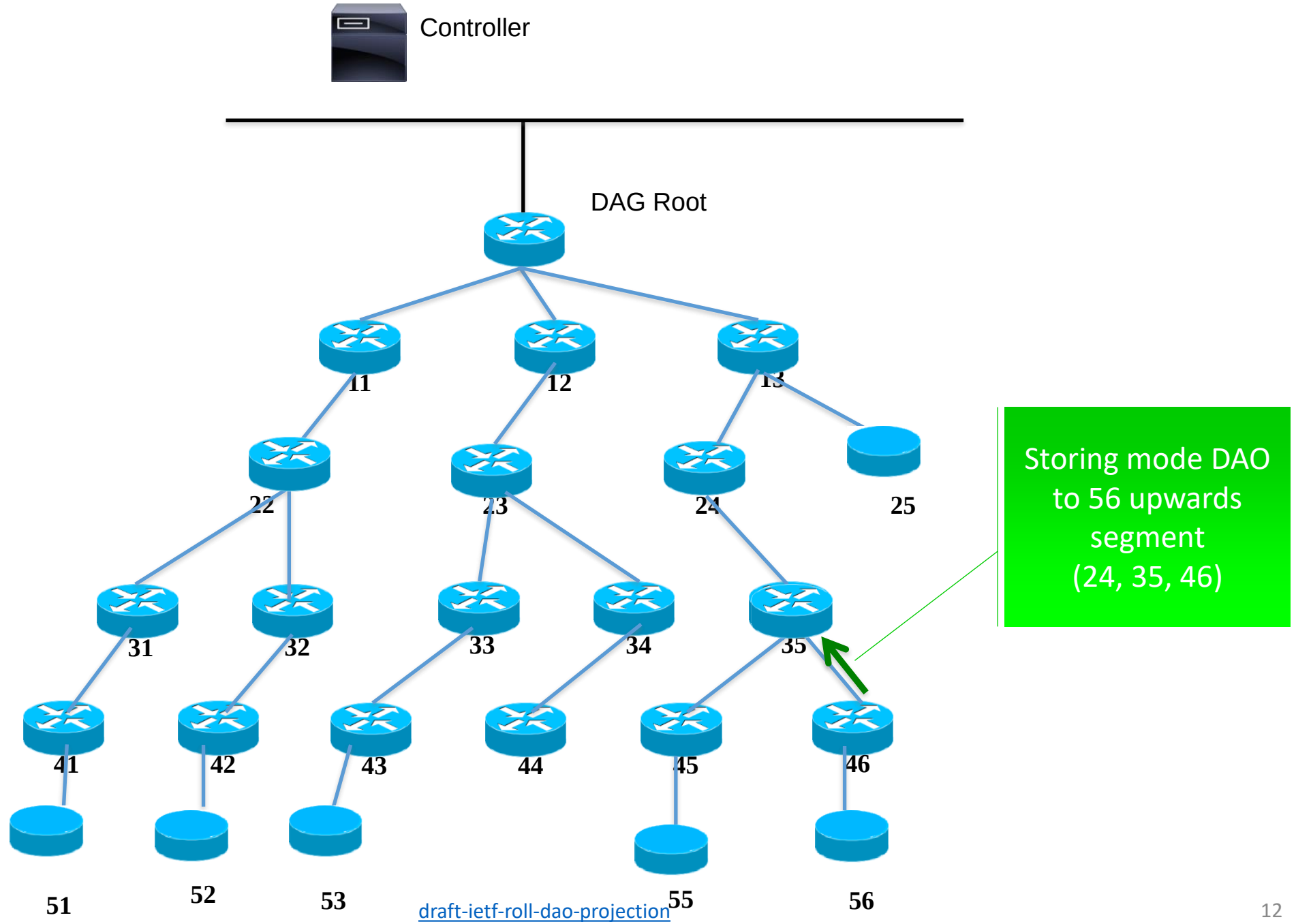


Projected-DAO to target 56 with path segment via 24 (ingress), 35, and then 46 (egress)

draft-ietf-roll-dao-projection



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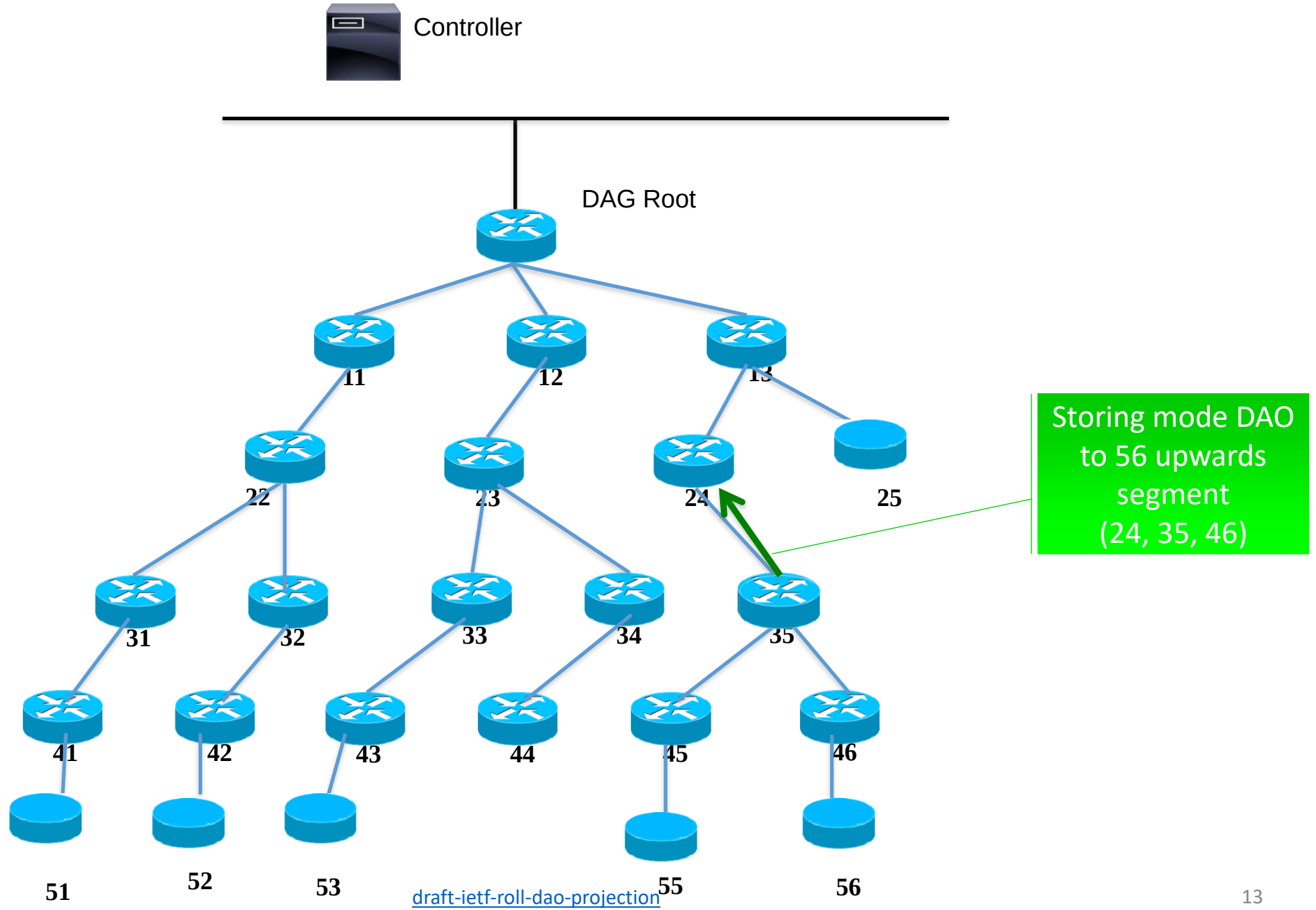

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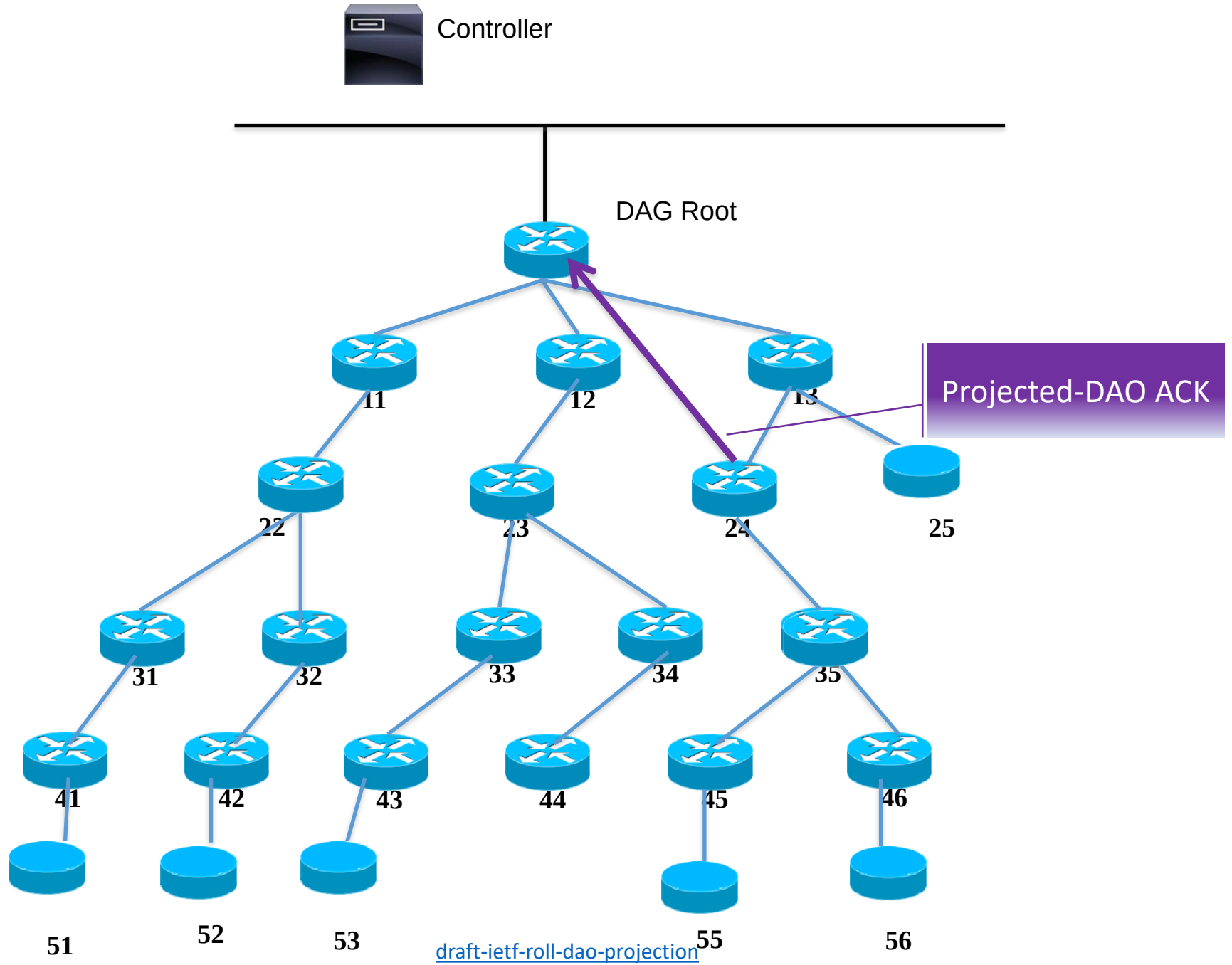

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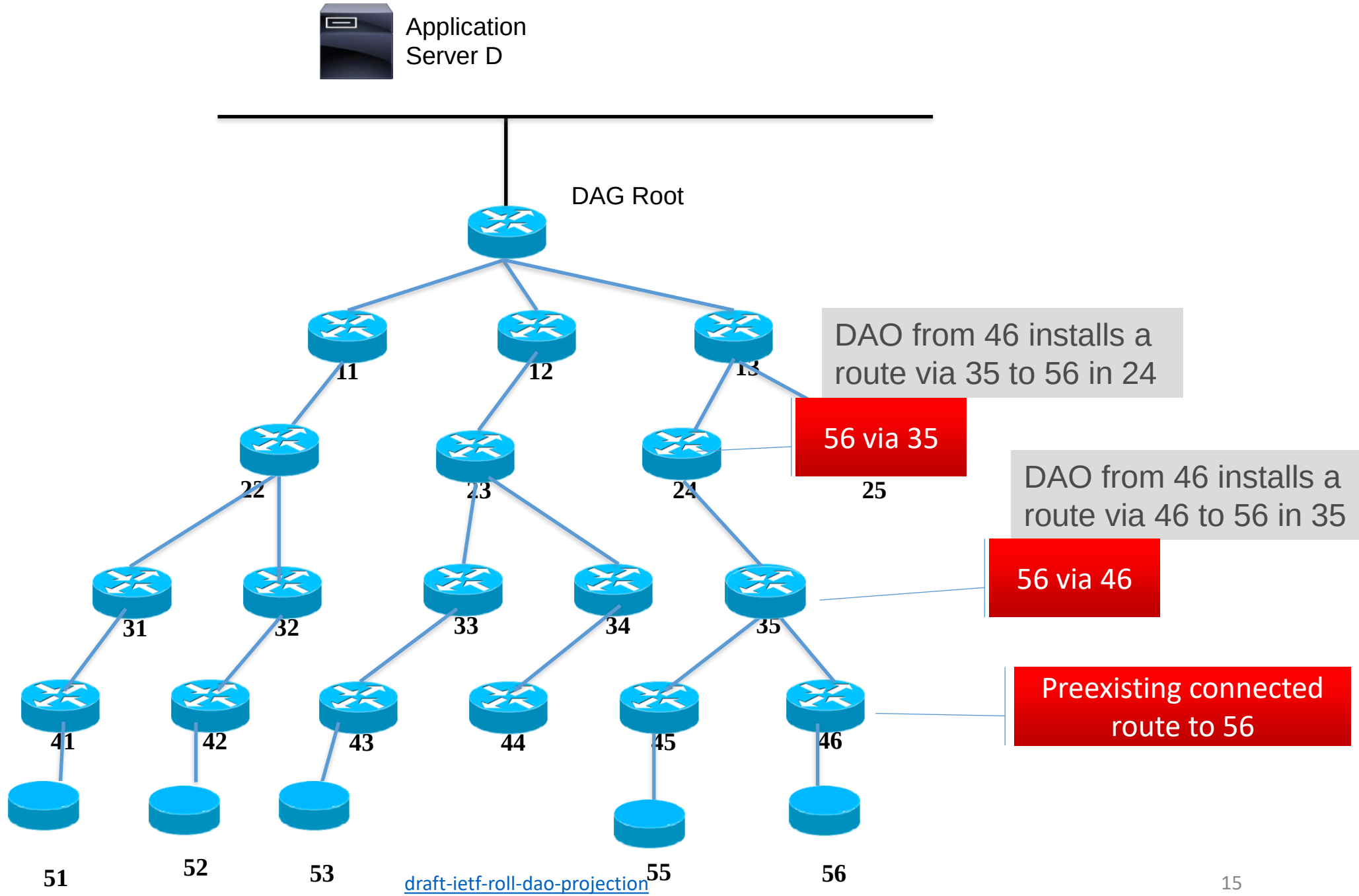

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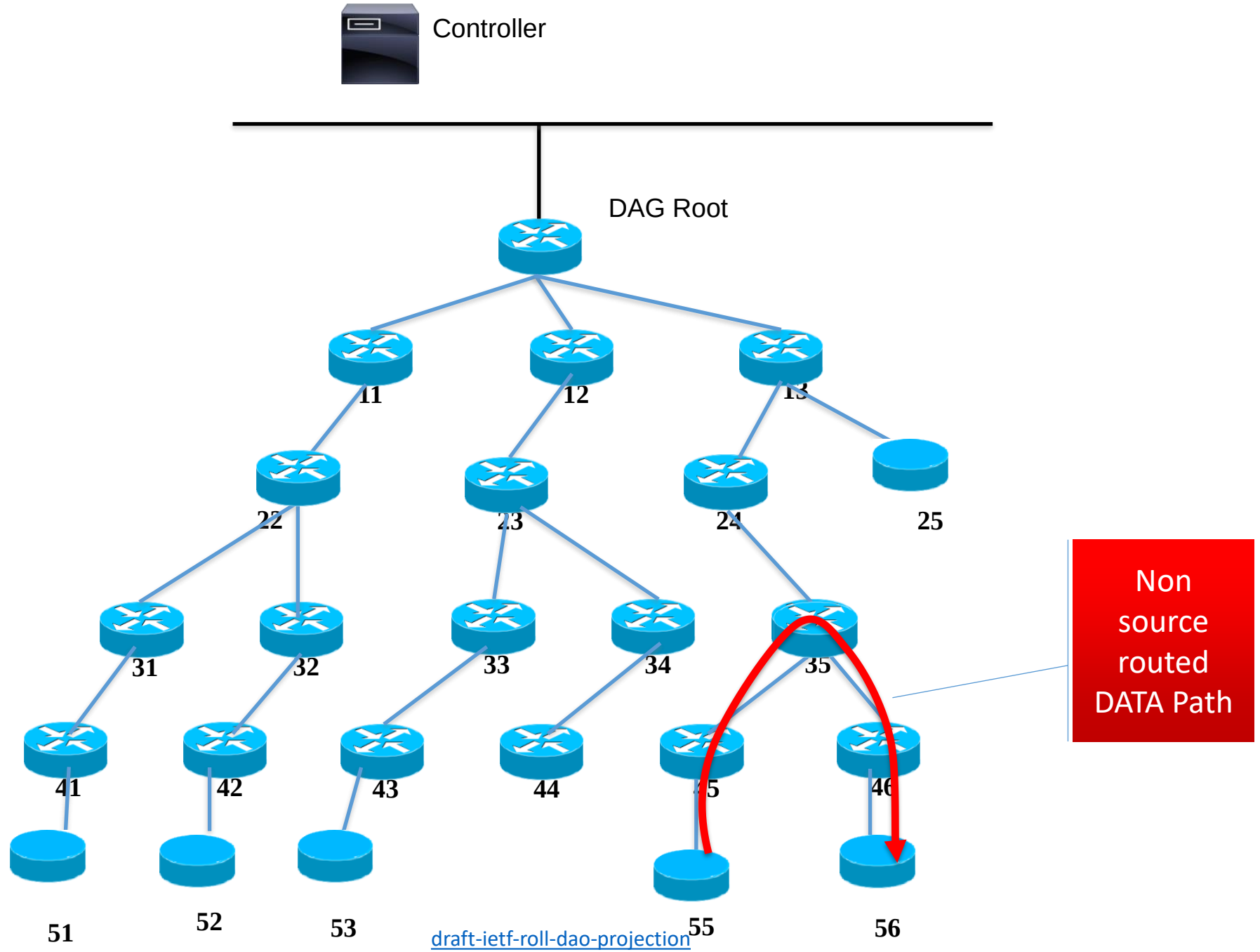

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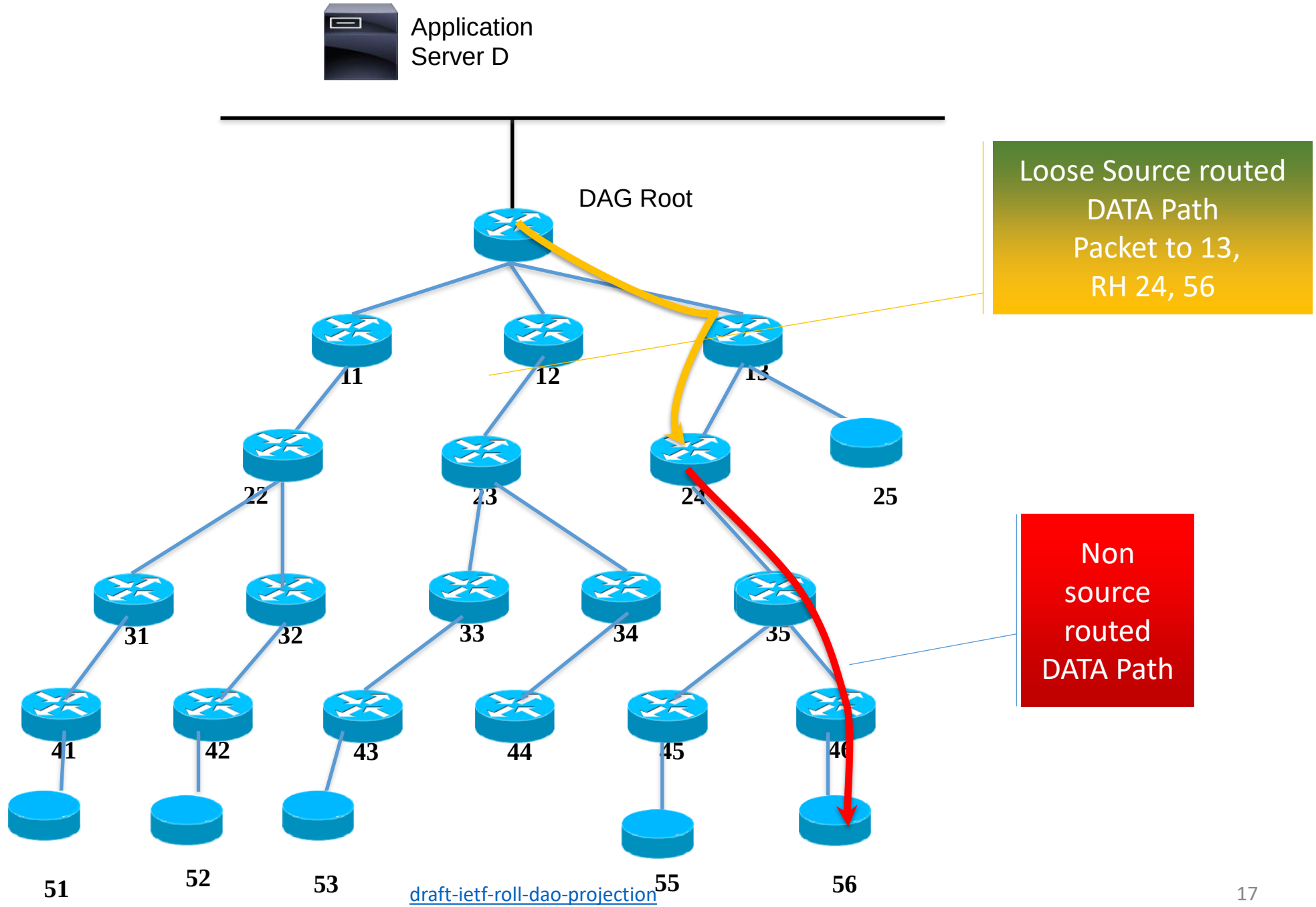

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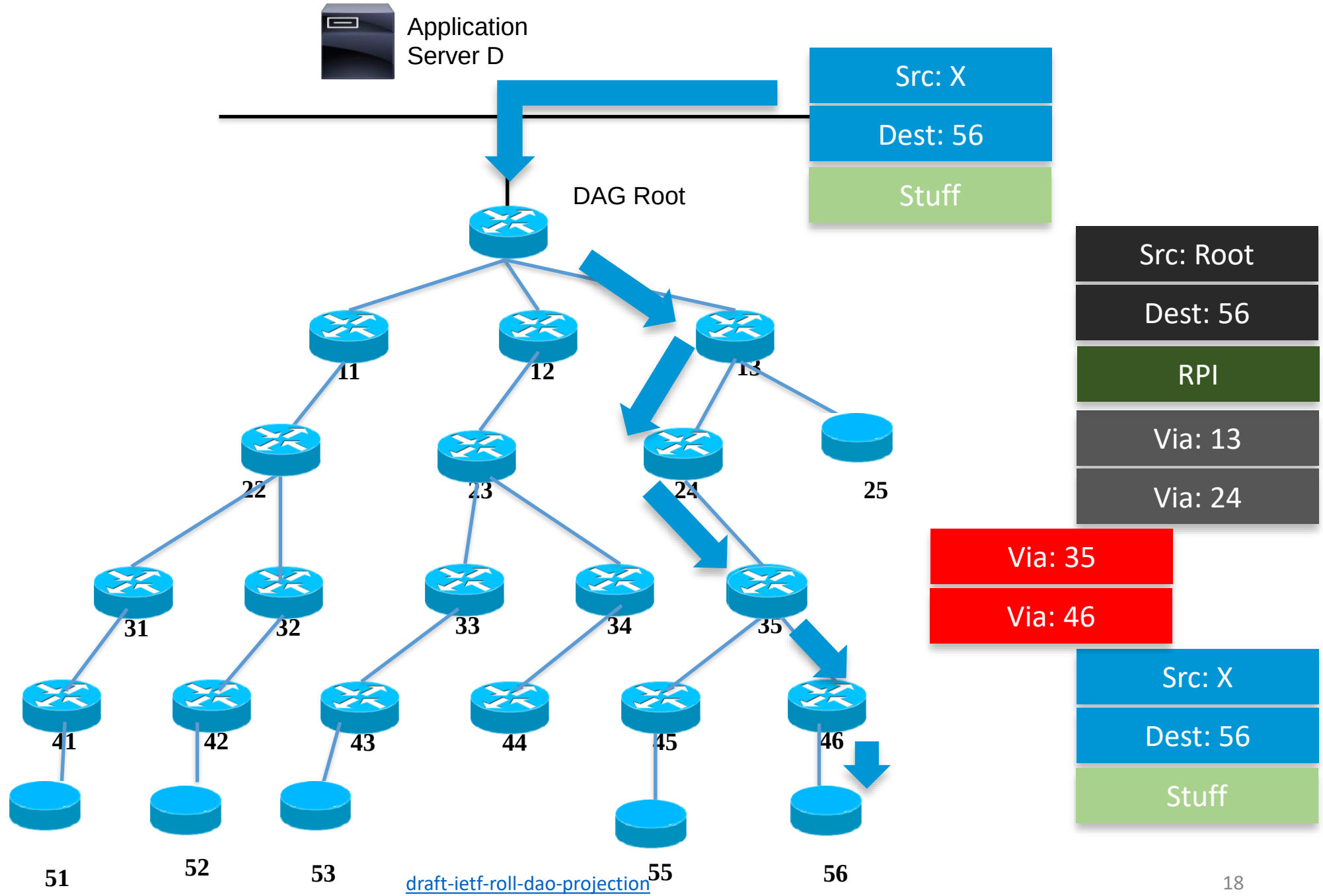
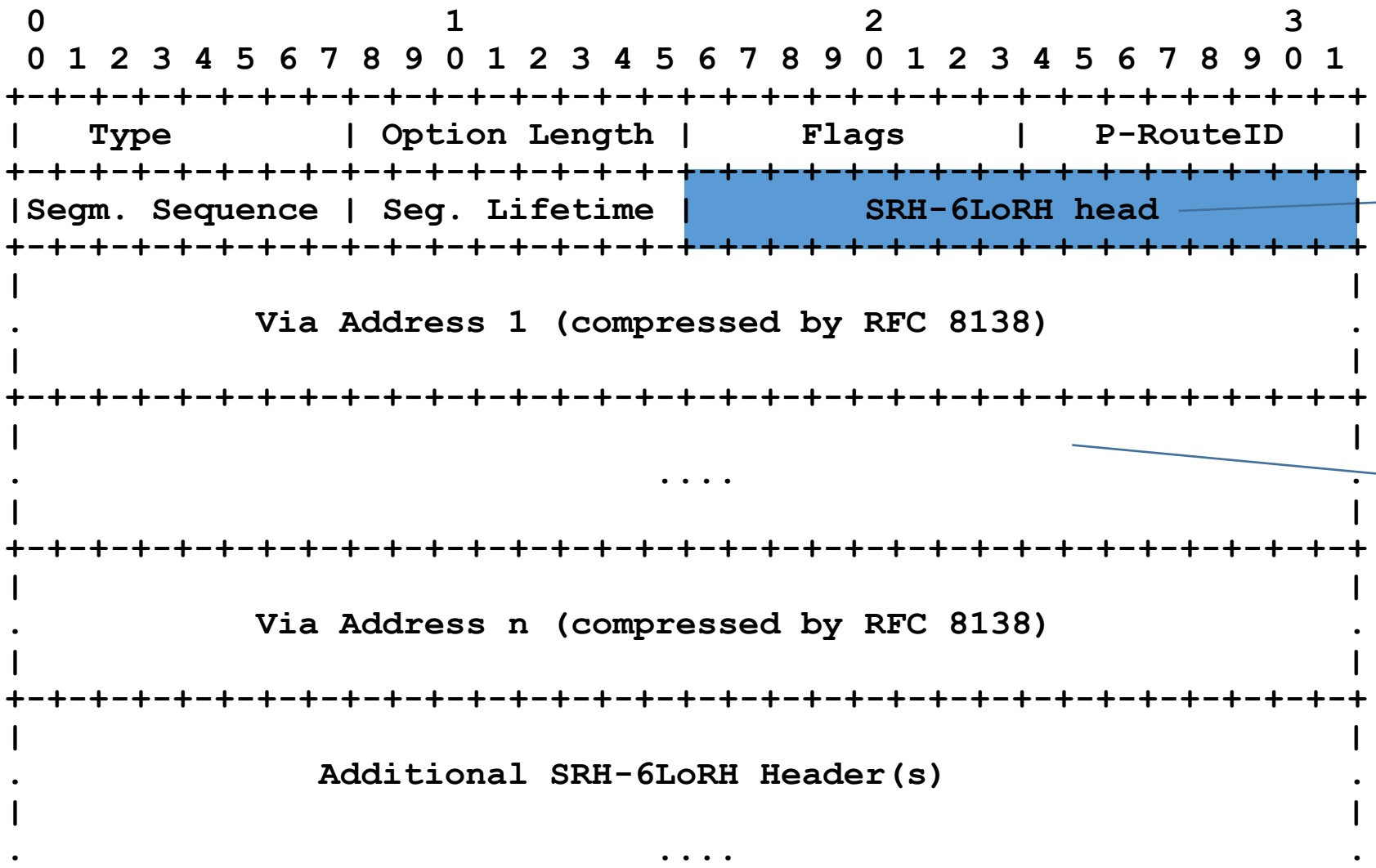


draft-ietf-roll-dao-projection

P-DAO construction

- RPL Target Options can be factorized
- But there is one and only one VIO (SF-VIO or SR-VIO)
- So the Ack management is easier
- VIO sent to egress; SR-VIO sent to ingress
- Track ID is a RPL local instance ID
- Taken from the Track Egress Name Space

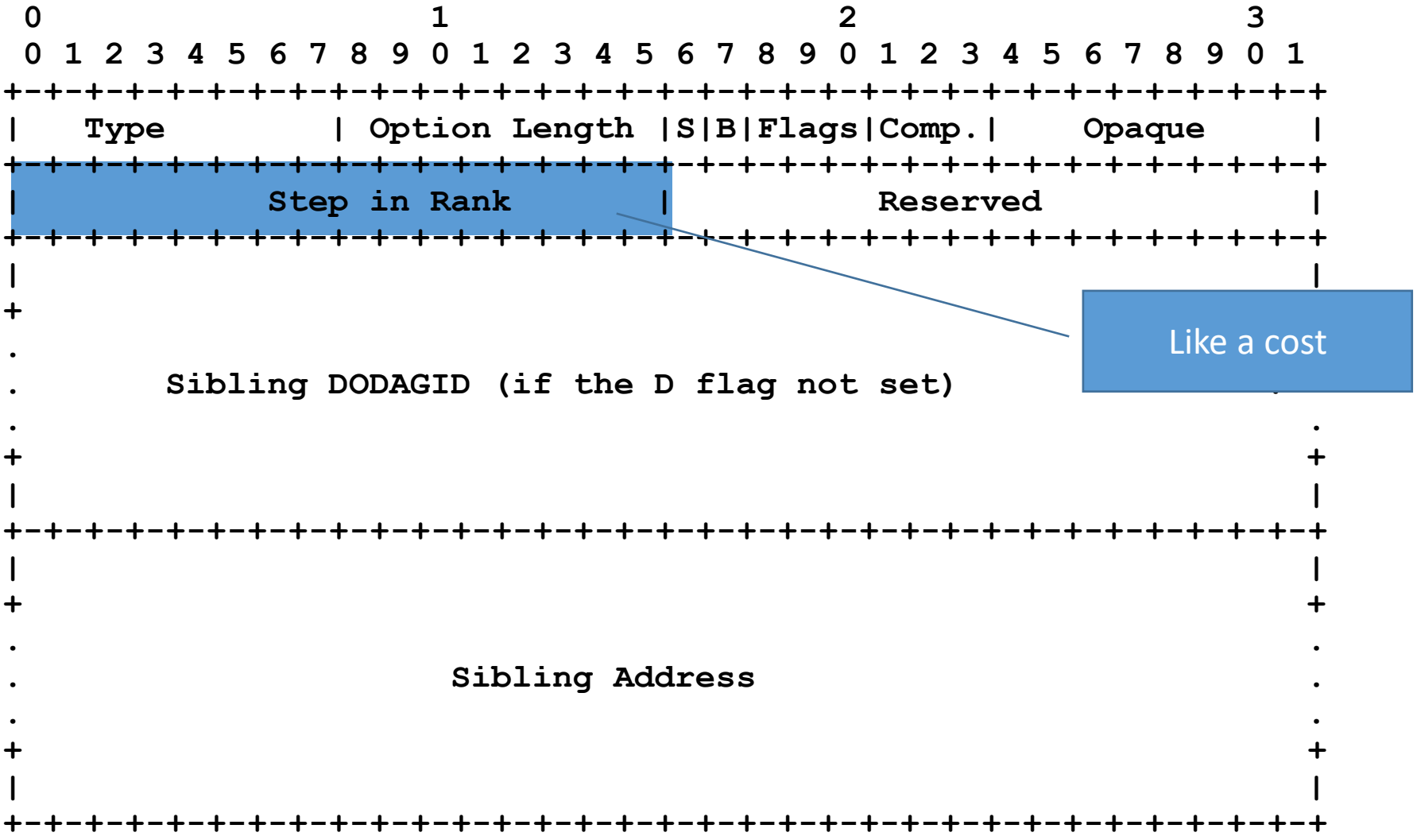
New Via Information Option Format



May be more than one in Non-storing Mode

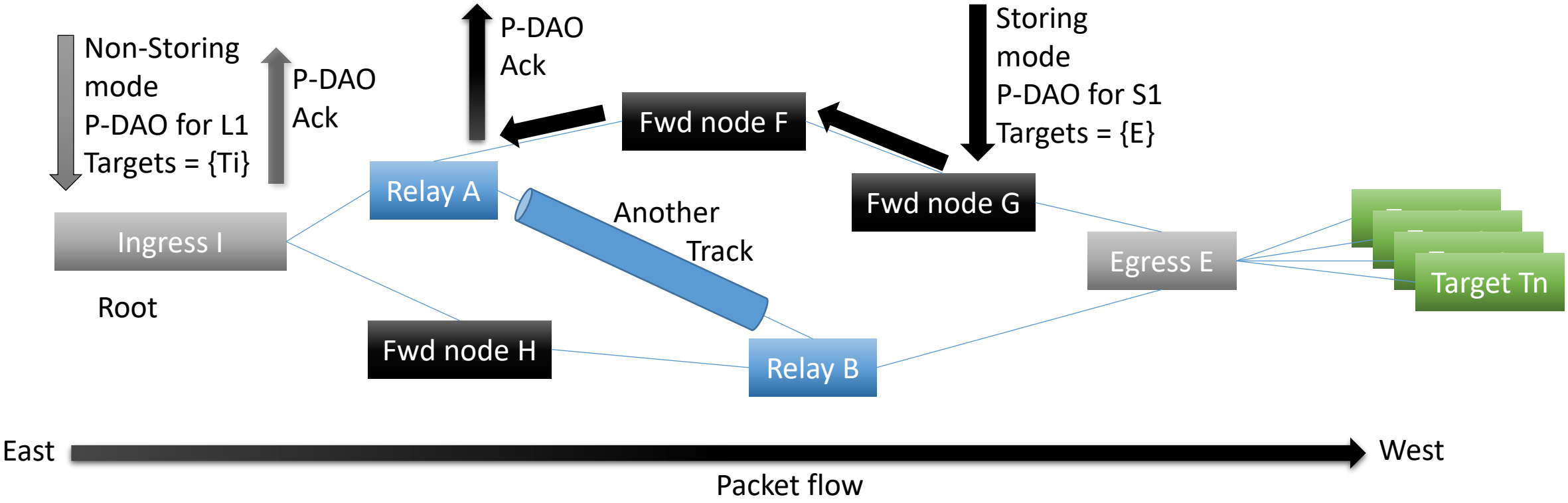
Must be optimized in Non-storing Mode, to be used as is in packets

New Sibling Information Option Format



In DAO and mcast DAO; mcast DAO allows indirect forwarding

The RPL Track: A local DODAG rooted at Ingress



Targets {Tx }

Legs L1 = I->A->E to {Ti} , L2 = I->B->E to {Ti} , L3 = I->A->B->E to {Ti}

Segments S1 = A=>F=>G to E , S2 = I=>H to B

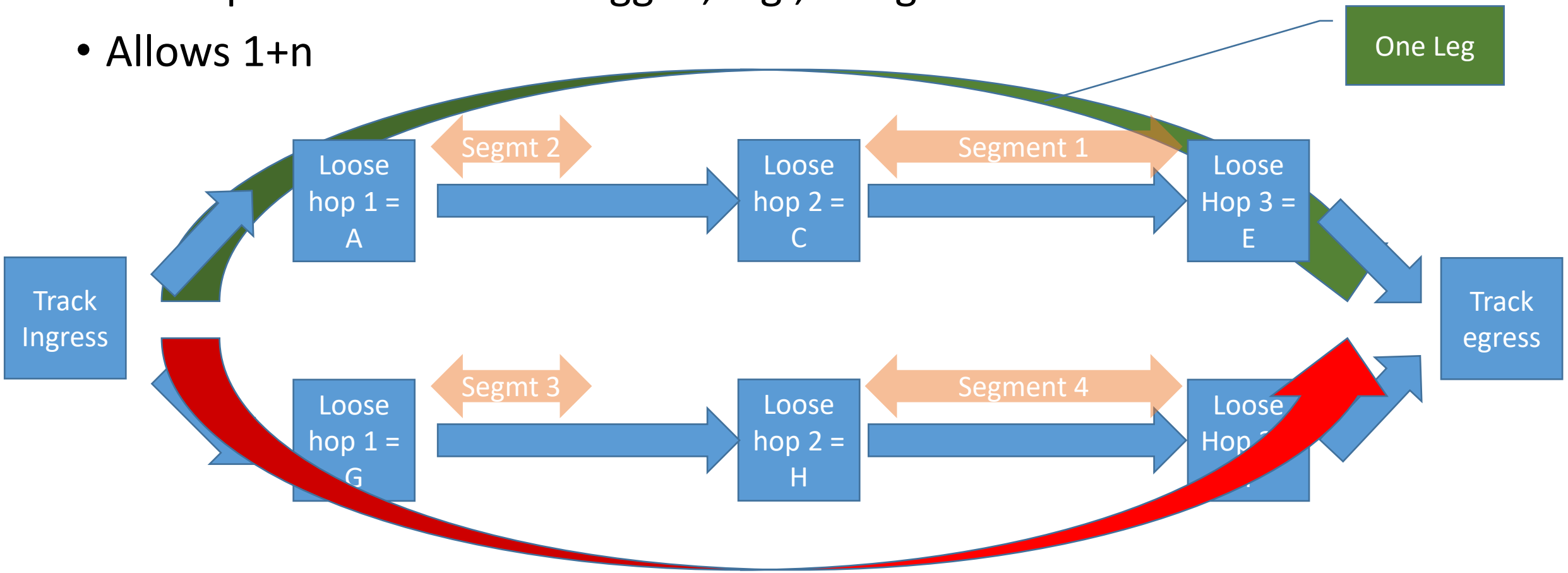
SubTracks Any Set ⊂ {L1, L2, L3} but { }

Some rules

- Track is set up by installing Legs and Segment
  - with the same Track ID
- Non-Storing Mode P-DAO signals a Leg
- Storing Mode P-DAO signals a Segment
- Storing Mode P-DAO enables loose hops
  - in Non-Storing main DODAG (typically TrackId is Global instance ID)
  - in Tracks (typically TrackId is Local instance ID to track Ingress)
- Track Egress is implicit Target in Non-Storing Mode
- Leg hop is either a Segment of this Track or another Track

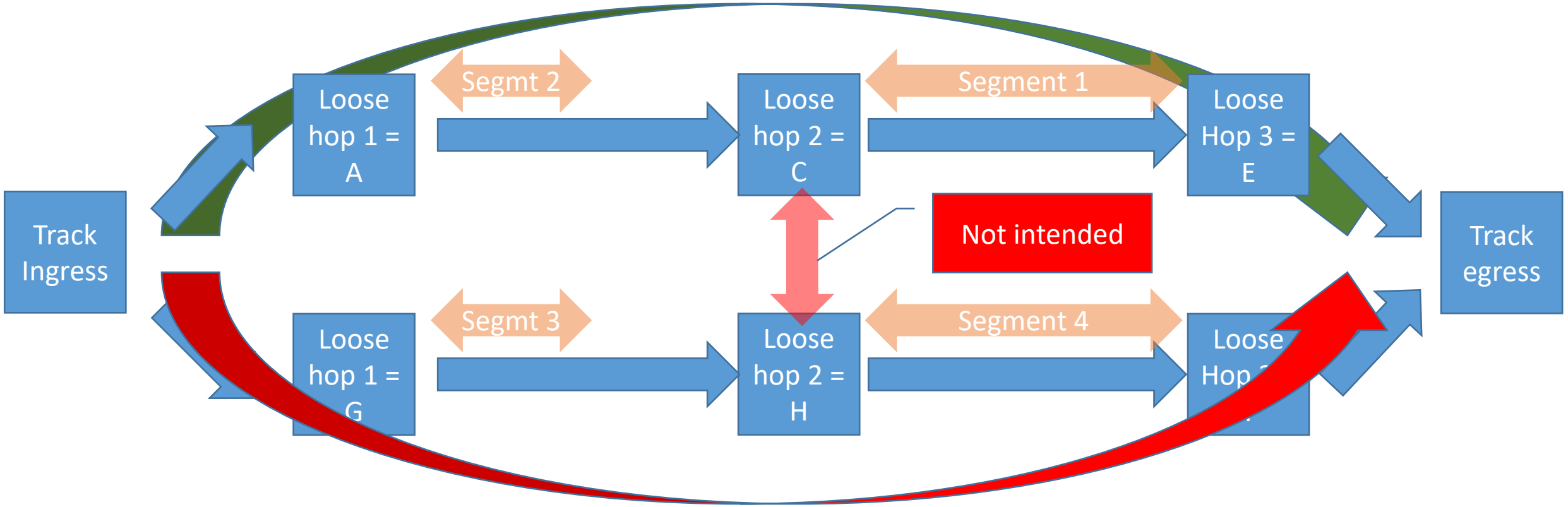
Complex track

- A complex track is multi-legged, e.g., 2 Legs below
- Allows 1+n



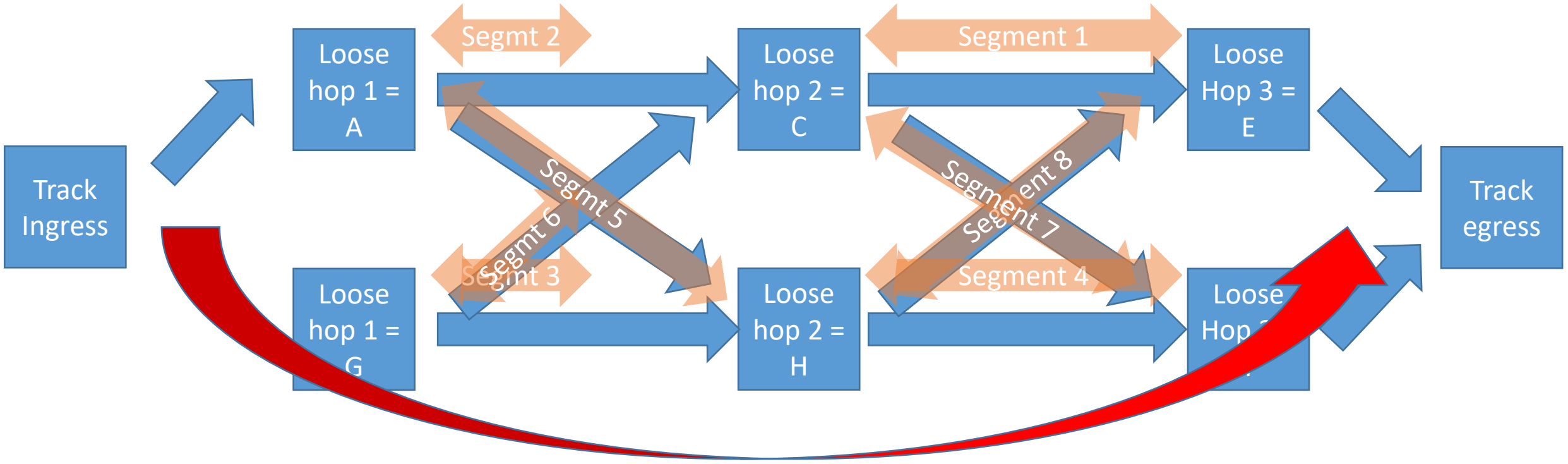
RPL vs RAW

- RPL has no North-South Segment



Inter Leg

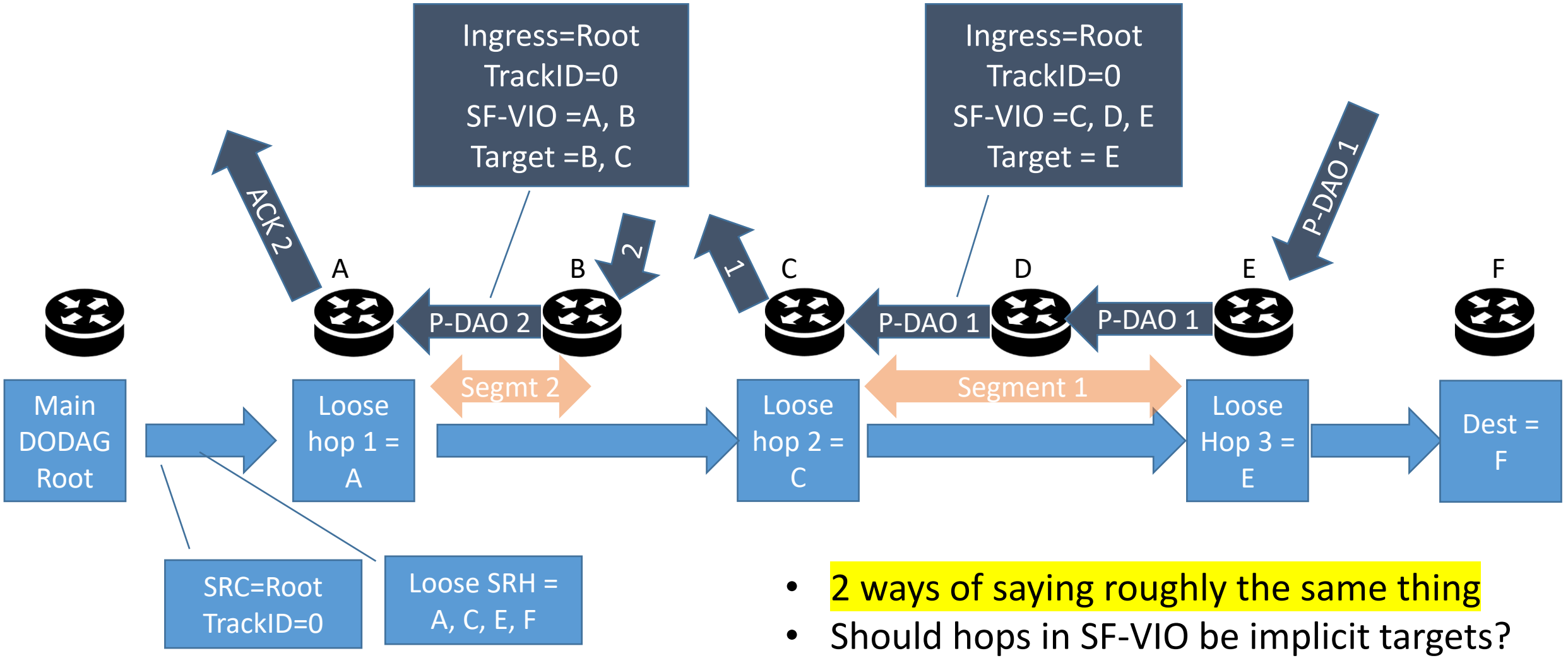
- RFC 6550 non-storing Target and Transit to indicate loose parent child relationship, many of them in one P-DAO



Encapsulation Details

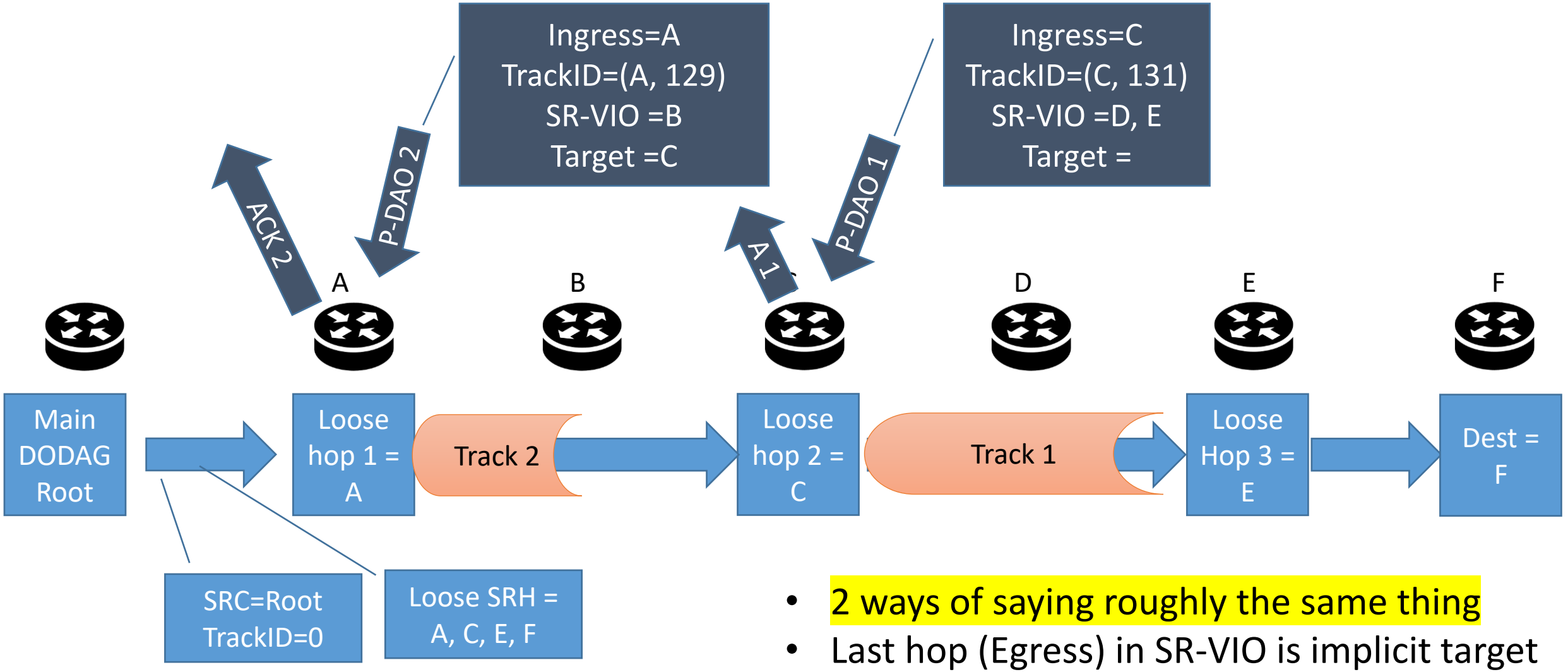
- Source of outer header MUST be Track Ingress- think DODAG Root
- RPL Instance ID in RPI MUST indicate TrackID (if not main DODAG)
- SR-VIO: Loose from Track Ingress, excluded, to Egress, included
  - Copied Verbatim in inserted SRH-6LoRH,
  - Requires encapsulation (can be recursive)
- SF-VIO: Strict from Segment Ingress to Egress, both included
  - No Encapsulation if Source and RPI both match Segment definition
  - A Segment is an Implicit Track if P-DAO Ingress == 1st SF-VIO entry
- TBD: matching rules, Flow Info option, when to tunnel?

Profile 1:
Compress SRH in main DODAG with strict SM Segments



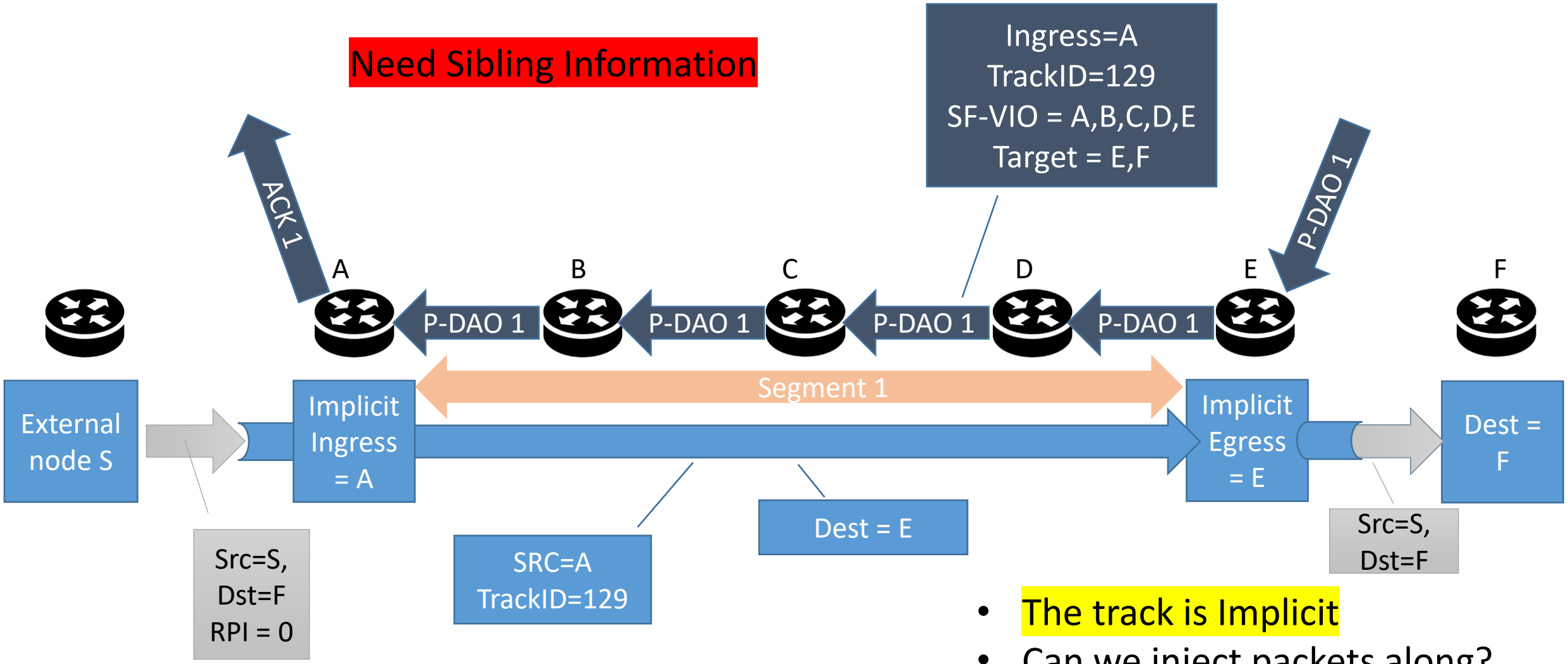
- 2 ways of saying roughly the same thing
- Should hops in SF-VIO be implicit targets?

Profile 2:
Compress SRH in main DODAG with Strict NSM Tracks



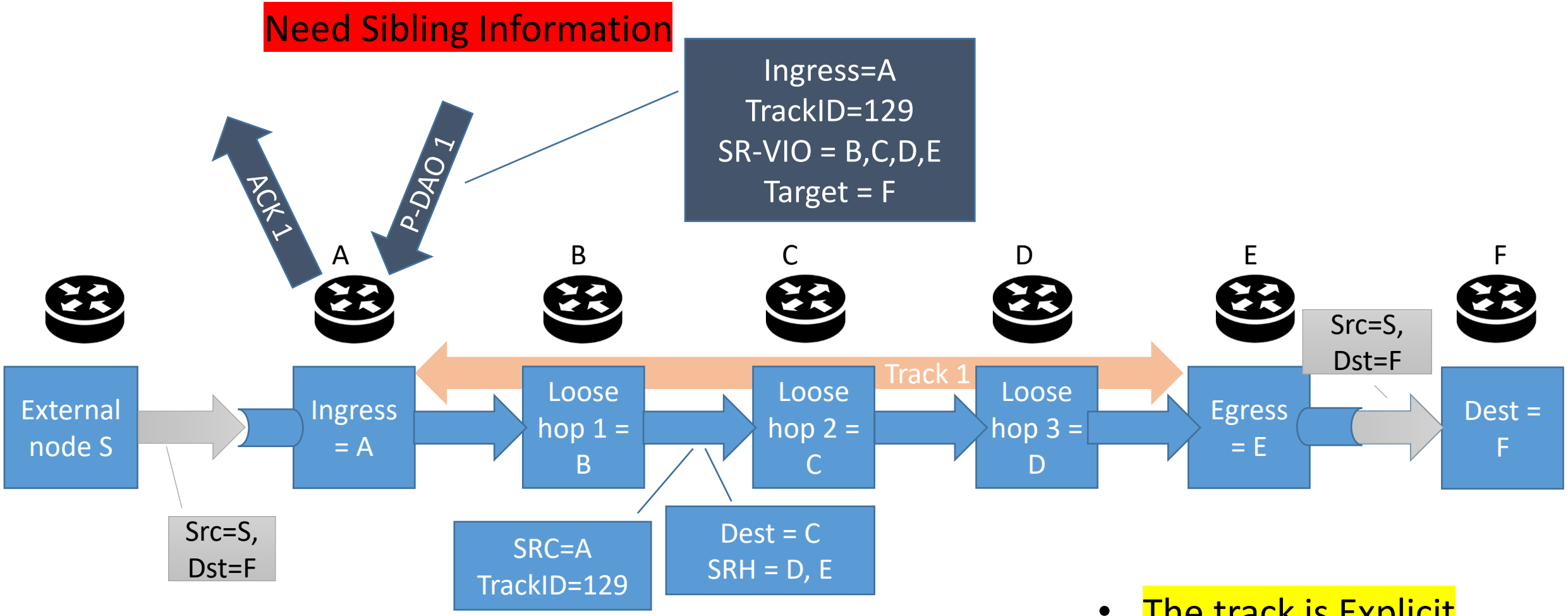
- 2 ways of saying roughly the same thing
- Last hop (Egress) in SR-VIO is implicit target

Profile 3: Implicit Track with Strict SM Segments,



- The track is Implicit
- Can we inject packets along?

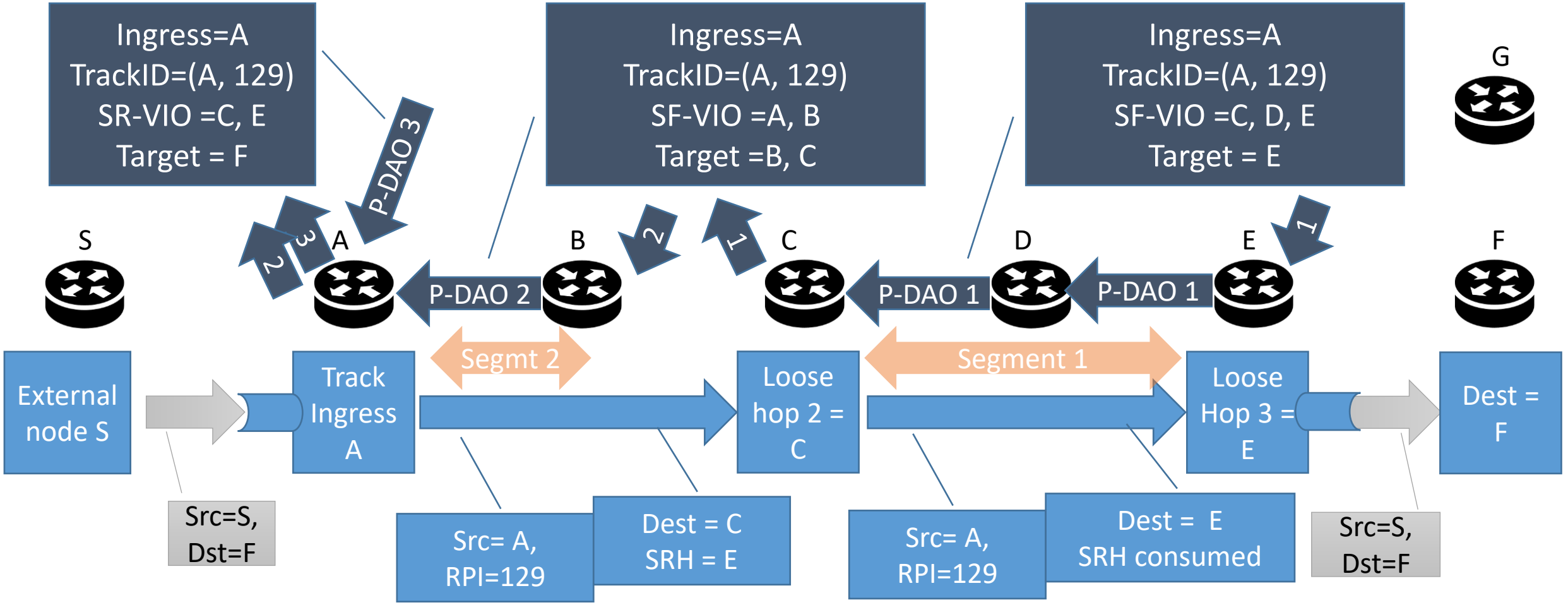
Profile 4: Strict NSM Explicit Track



- The track is Explicit
- Same encap as profile 2

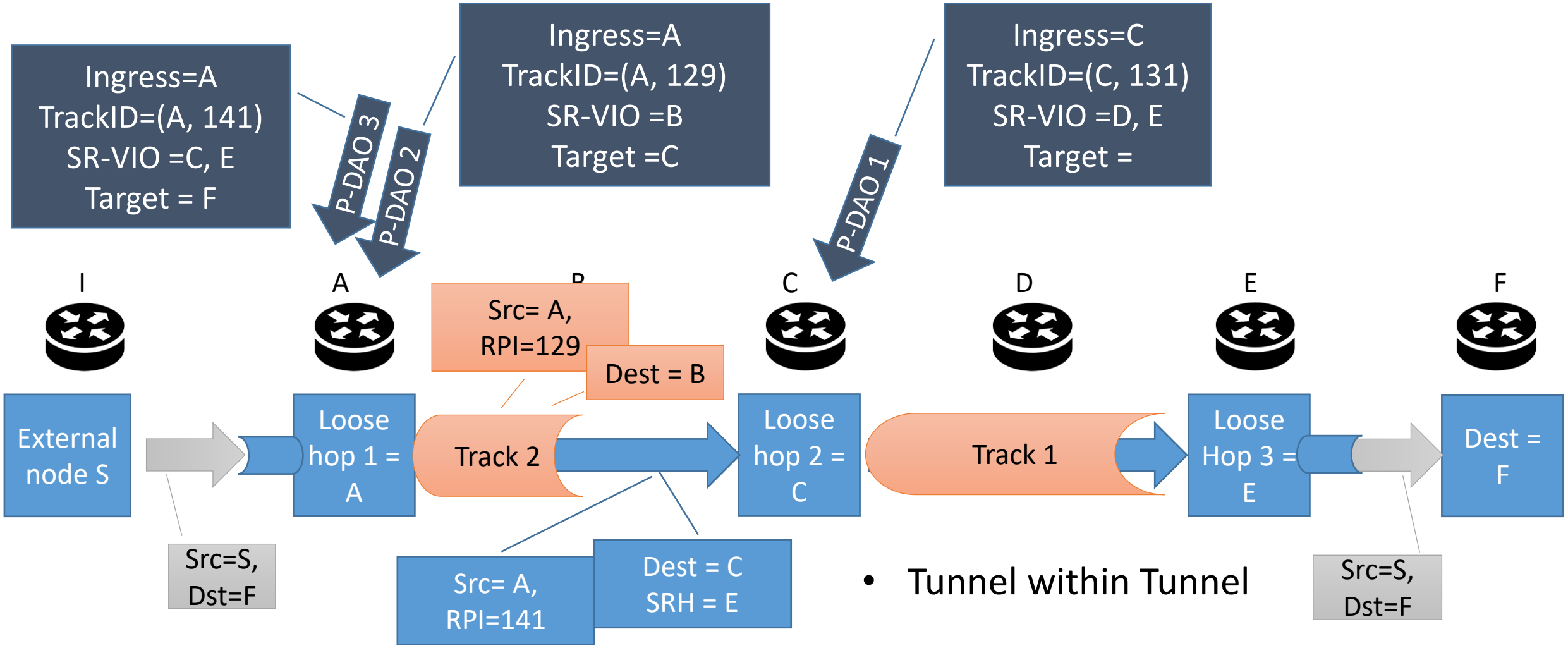
Profile 5: Compress SRH in Track with Strict SM Segments

Need Sibling Information



- Same as Profile 1, but for Track

Profile 6:
Compress SRH in Track with NSM Tracks (Recursive?)



- Tunnel within Tunnel

Extending RFC 9010: IPv6 Neighbor Discovery Multicast Address Listener and Prefix Registration

draft-ietf-6lo-multicast-registration
draft-thubert-6lo-prefix-registration (NEW!)

Pascal Thubert

IETF 115

London

6LoWPAN ND (IPv6 Stateful Address Autoconfiguration)

RFC 6775 (original 6LoWPAN ND)

- Defines ARO for registration and DAD operations for stateful AAC

RFC 8505 (Issued 11/2018)

- The protocol agnostic registration for ULA/GUA for proxy ND and routing services
- Analogous to a Wi-Fi association but at Layer 3: a deterministic and query-able state for all addresses

RFC 8929 (Issued 11/2020)

- Federates 6lo meshes over a high-speed backbone
- ND proxy analogous to Wi-Fi bridging but at Layer 3

RFC 8928 (Issued 11/2020)

- Protects addresses against theft (Crypto ID in registration)

draft-ietf-6lo-multicast-registration

- Extends RFC 8505 for multicast and anycast

draft-thubert-6lo-unicast-lookup

- Provides a 6LBR on the backbone to speed up DAD and lookup
- Coexistence with classical ND

draft-thubert-6lo-prefix-registration

- Extends RFC 8505 for prefixes

Changes in draft-ietf-6lo-multicast-registration since IETF 114

- Moved from 7 to 11, introduced terminology
- “Update RFC 6550” beefed up,
  - discussion on merging different sources vs lifetime and ROVR
- Freshness comparison only from the same source
- New P field instead of flags (though same binary) -> next slide
- Use “subscription” instead of “registration” for A and M
- Updated Consistent Uptime Option; (in vs separate) still not resolved, kept in -> next slide

P Field: Adding Room For Prefix Registration

P is a new 2-bits field in EARO, DAR, and RTO

Turning the A and M flags into a field frees up one value:

Value	Meaning	Reference
0	Registration for a Unicast Address	This RFC
1	Registration for a Multicast Address	This RFC
2	Registration for an Anycast Address	This RFC
3	Unassigned	This RFC

Was: M flag

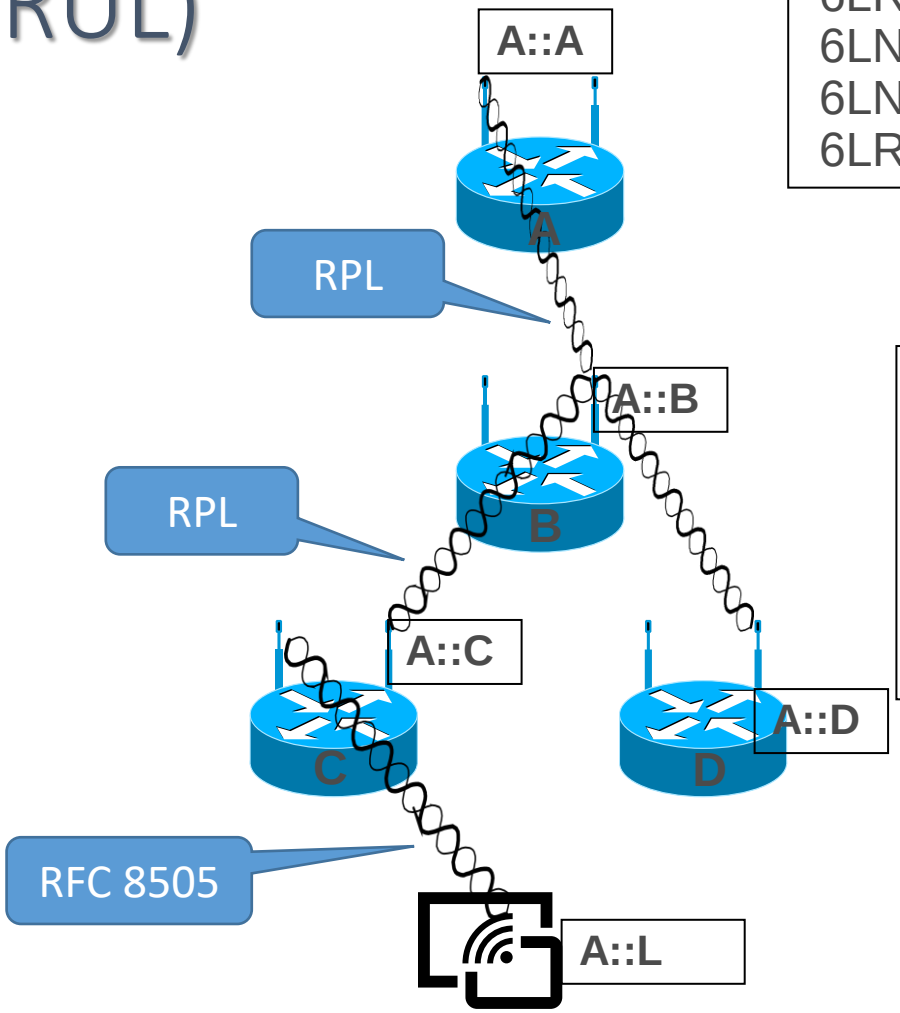
Was: A flag

Reserved

For Prefix Registration

RFC 9010 (RUL)

6LR advertises A:: in RAs
6LN autoconfigures A::L
6LN registers A::L with « R » flag set
6LR injects the address as external host route in RPL



C:
::/0 via A::B
A::B connected
A::C self
A:: ~onlink

Target A::L via
Transit A::C (Ext)

A: (root)
A::A self
A::B connected
A::C via A::B
A::L via A::C
A::D via A::B
A:: ~onlink

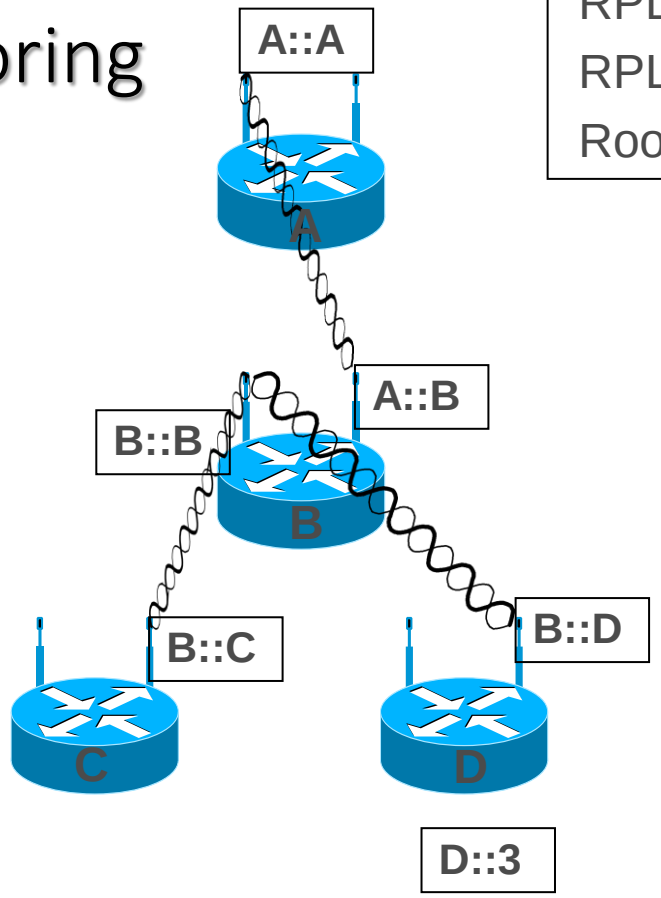
A::L via A::C via A::B connected

Let it be for prefixes!

- Hosts may own prefixes -> and routers may connect to prefixes
  - Network in Node / recursive networking
  - Kubernetes / Private IPv4 realms
  - Directly connected (no routing)

Owned prefix routing (non-storing mode)

Parent is default GW, advertizes owned PIO (L bit on)
RPL Router autoconfigures Address from parent PIO
RPL Router advertises Prefix via Address to Root
Root recursively builds a Routing Header back



C:
::/0 via B::B
B:: connected
C:: connected

Target C::/ via
Transit B::C

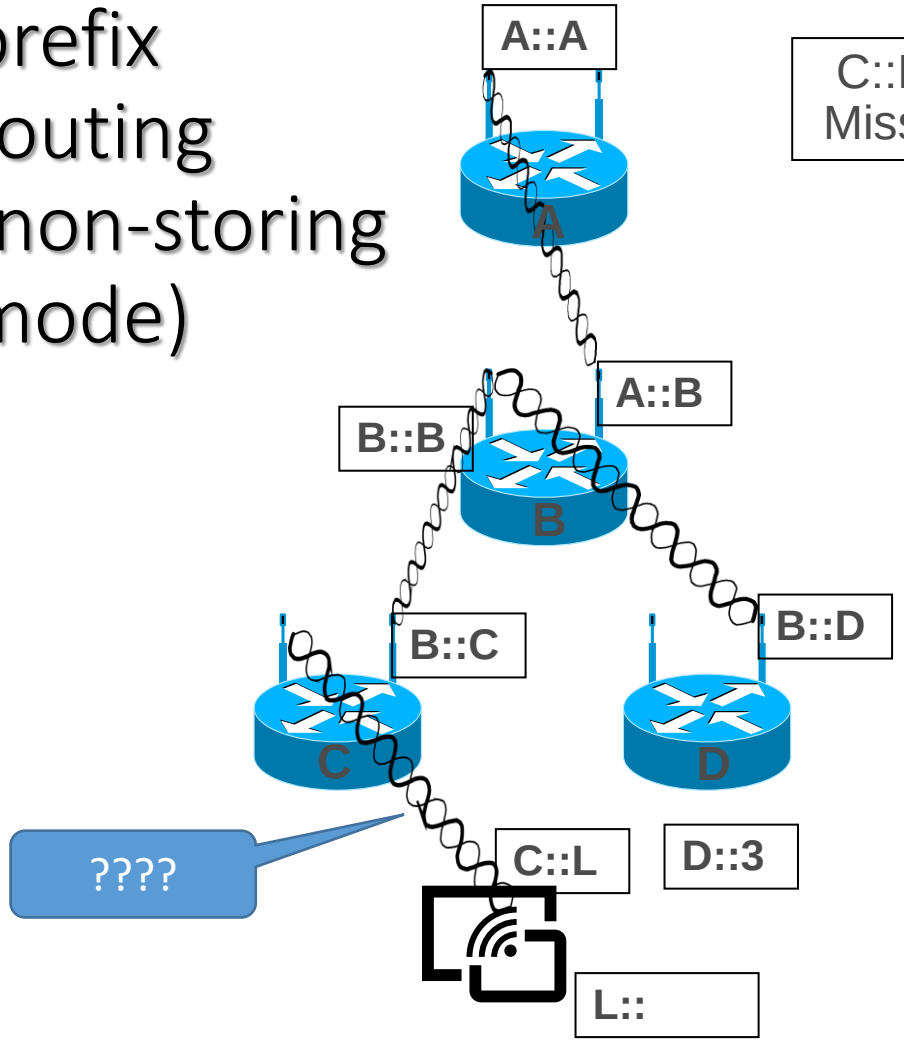
B:
::/0 via A::A
A:: connected
B:: connected

A: (root)
A:: connected
B:: via A::B
C:: via B::C
D:: via B::D

D:
::/0 via B::B
B:: connected
D:: connected

D::3 via B::D via A::B connected

Owned prefix routing (non-storing mode)



C::L is reachable but L:: is not
Missing equivalent of RFC 8505/9010 for prefixes

C:
::/0 via B::B
B:: connected
C:: connected

Target C::/ via
Transit B::C

A: (root)
A:: connected
B:: via A::B
C:: via B::C
D:: via B::D

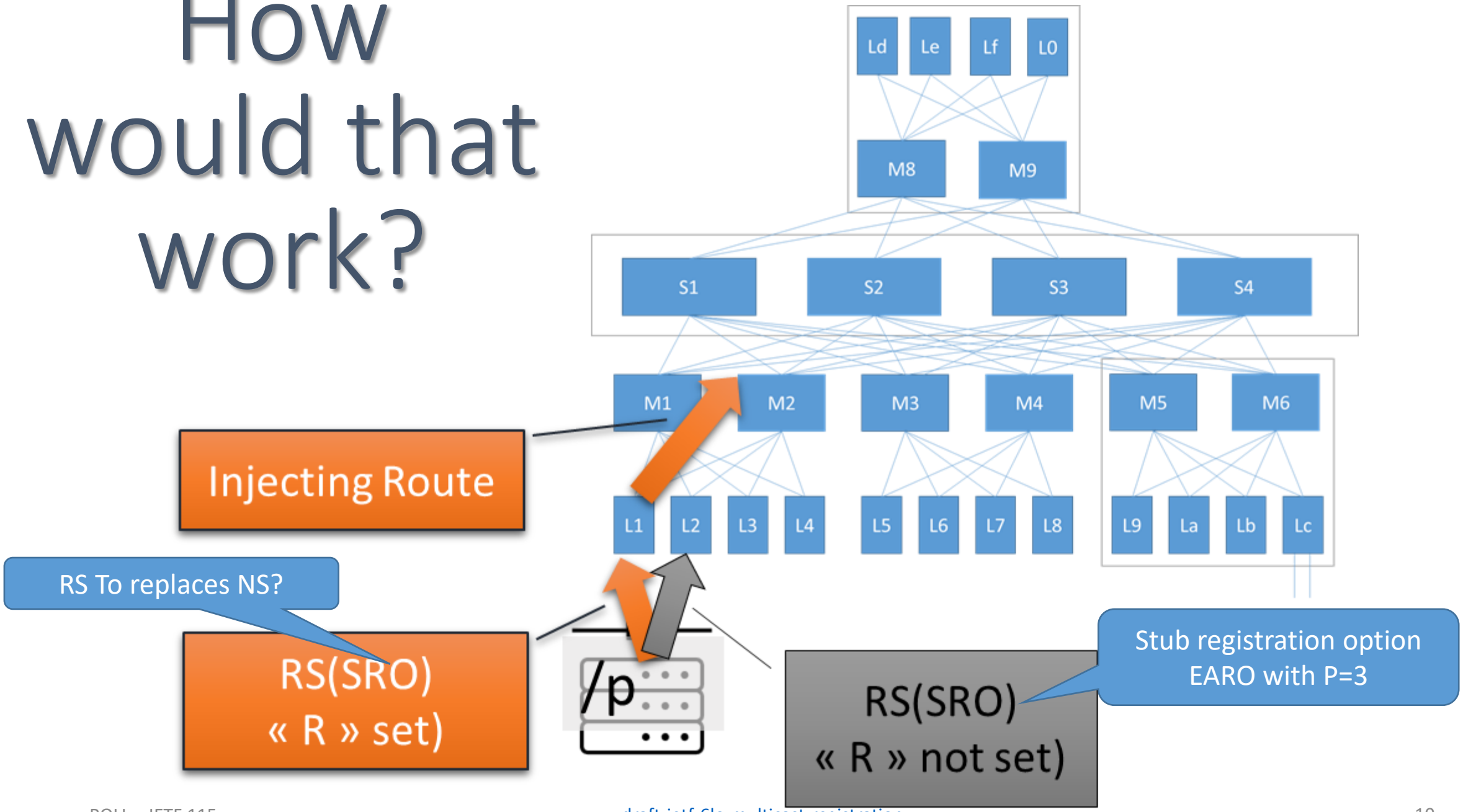
L:: unreachable

C::L via B::C via A::B connected

What becomes of DAD?

- **Need to consider prefix aggregation and nesting**
  - Provisioned Mobile Networks should be unique
  - Auto-allocation?

How would that work?

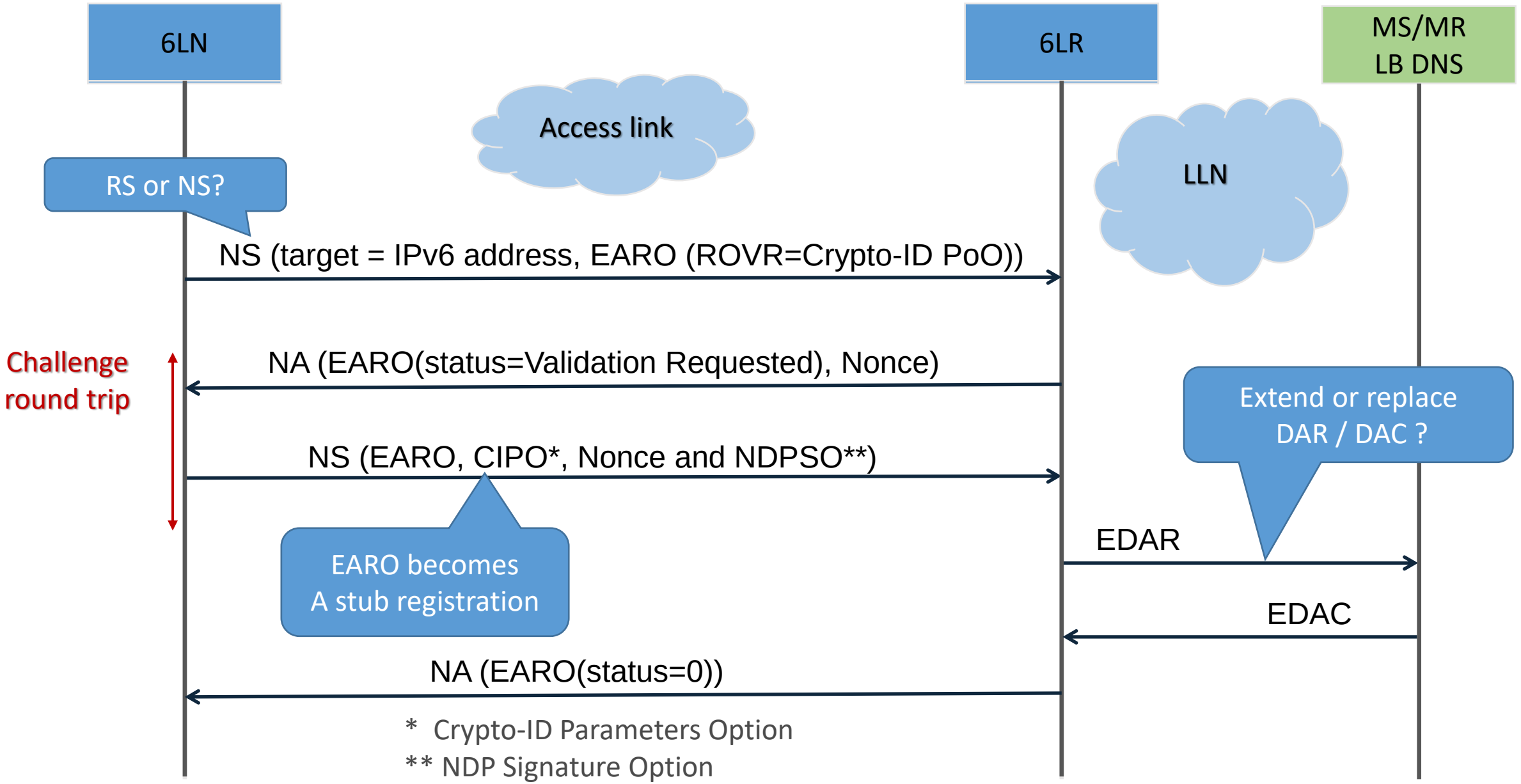


draft-ietf-6lo-multicast-registration

Extending the P field

- P is a 2-bits field in EARO, DAR, and RTO
- Defined the Multicast Address Registration draft

Value	Meaning	Reference
00	Registration for a Unicast Address	mcast RFC
01	Registration for a Multicast Address	mcast RFC
10	Registration for an Anycast Address	mcast RFC
~~11~~	~~Unassigned~~	~~mcast RFC~~
11	Registration for a prefix	This RFC


6LN
6LR
MS/MR
LB DNS
Access link
LLN
RS or NS?
NS (target = IPv6 address, EARO (ROVR=Crypto-ID PoO))
Challenge
round trip
NA (EARO(status=Validation Requested), Nonce)
Extend or replace
DAR / DAC ?
NS (EARO, CIPO*, Nonce and NDPSO**)
EARO becomes
A stub registration
EDAR
EDAC
NA (EARO(status=0))
* Crypto-ID Parameters Option
** NDP Signature Option

Could do’s

- Adding stub prefix advertisement vs. host today
  - Indicate prefix type e.g., a /96 to embed an IPv4 address
  - Proof of ownership (PoO) per RFC 8928
- Adding policy / ACLs
  - Signal partial micro-segmentation (offload), who can talk to me
- Adding preference to influence load balancing
  - worker capacity (clusters / containers)
  - Access bandwidth /
  - multihoming / preferred interface / anycast
- Tenant ID / VRF ID / RPL instanceID
  - Route tags, RH

Ask

- NS vs RS?
- Name EARO with P=3 an SRO?
- Support of IPv4 with a /96 to embed an IPv4 subnet?
- Proof of ownership (PoO) per RFC 8928

Open Floor