

# IETF 113 ROLL - Routing over Low-Power And Lossy Networks

**Chairs:**

Dominique Barthel

Ines Robles

**Secretary:**

Michael Richardson

23 March 2022

This session is being recorded

IETF 113 Vienna  
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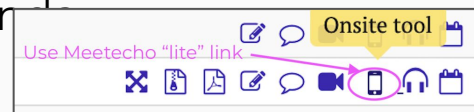


This session is being recorded

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- Use of a headset is strongly recommended

# Resources for IETF 113 Vienna

- Agenda  
<https://datatracker.ietf.org/meeting/agenda>
- Meetecho and other information:  
<https://www.ietf.org/how/meetings/113/preparation>
- If you need technical assistance, see the Reporting Issues page:  
<http://www.ietf.org/how/meetings/issues/>

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- [BCP 9](#) (Internet Standards Process)
- [BCP 25](#) (Working Group processes)
- [BCP 25](#) (Anti-Harassment Procedures)
- [BCP 54](#) (Code of Conduct)
- [BCP 78](#) (Copyright)
- [BCP 79](#) (Patents, Participation)
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Source: <https://www.ietf.org/about/note-well/>

# Resources for ROLL@IETF 113 Vienna

- Remote Participation

- Meetecho: <https://meetings.conf.meetecho.com/ietf113/?group=roll&short=&item=1>
- Material: <https://datatracker.ietf.org/meeting/113/session/roll>
- Jabber: xmpp:[roll@jabber.ietf.org](https://roll@jabber.ietf.org)?join
- CodiMD: <https://notes.ietf.org/notes-ietf-113-roll>
- Minute takers: **Please volunteer, thank you :)**

# Agenda

Wednesday, March 23th, 2022

12:00-13:00 (UTC) Wednesday Afternoon session I

Time (UTC)	Duration	Draft/Topic	Presenter
12:00 - 12:20	20 min	WG Status	Ines/Dominique
12:20 - 12:35	15 min	draft-ietf-roll-dao-projection	Pascal
12:35 - 12:50	15 min	draft-ietf-roll-enrollment-priority	Michael
12:50 - 12:55	5 min	draft-ietf-6lo-multicast-registration	Pascal
12:55 - 13:00	5 min	Open Floor	Everyone

# Draft status

Common Ancestor Objective Function and Parent Set DAG Metric Container Extension <a href="#">draft-ietf-roll-nsa-extension-10</a>	AD evaluation, revised I-D needed
Supporting Asymmetric Links in Low Power Networks: AODV-RPL <a href="#">draft-ietf-roll-aodv-rpl-13</a>	IESG evaluation, AD follow-up Short discussion today
Root initiated routing state in RPL <a href="#">draft-ietf-roll-dao-projection-24</a>	Discussed today To be WGLC'ed
Controlling Secure Network Enrollment in RPL Networks <a href="#">draft-ietf-roll-enrollment-priority-06</a>	Discussed today
Mode of Operation extension <a href="#">draft-ietf-roll-mopex-04</a>	waiting for attention
RPL Capabilities <a href="#">draft-ietf-roll-capabilities-09</a>	waiting for attention
RPL Storing Root-ACK <a href="#">draft-jadhav-roll-storing-rootack-03</a>	WG adoption to be called
RNFD: Fast border router crash detection in RPL <a href="#">draft-ietf-roll-rnfd-00</a>	New Work adopted by the WG



# Milestones: proposed changes

Initial submission of a root initiated routing state in RPL to the IESG <a href="#">draft-ietf-roll-dao-projection</a>	2022
Initial submission of Enabling secure network enrollment in RPL networks draft to the IESG <a href="#">draft-ietf-roll-enrollment-priority</a>	2022
Initial submission of <b>Mode of Operation extension and Capabilities</b> for RPL to the IESG <a href="#">draft-ietf-roll-mopex-cap</a>	2022 2022
Initial submission of “RNFD: Fast border router crash detection in RPL” to the IESG <a href="#">draft-ietf-roll-rnfd</a>	2023
Initial submission of a proposal to augment DIS flags and options to the IESG <a href="#">draft-ietf-roll-dis-modifications</a>	2023
Initial submission of a YANG model for MPL to the IESG <a href="#">draft-ietf-roll-mpl-yang</a>	?
Initial submission of a proposal for Source-Route Multicast for RPL to the IESG <a href="#">draft-ietf-roll-ccast</a>	?
Recharter WG or close	2023

# Open Tickets

draft-ietf-roll-enrollment-priority Public

Issues 7 Pull requests 4 Discussions Actions Projects Wiki Security

Filters

☐ 7 Open ✓ 1 Closed

- ☐ ☒ add explicit lollipop counter into enrollment priority option  
#13 opened on Nov 24, 2021 by mcr
- ☐ ☒ should root explicitly reset trickle timer?  
#12 opened on Nov 24, 2021 by mcr
- ☐ ☒ what EB and priority, if any should a node with no feasible parent emit?  
#11 opened on Nov 24, 2021 by mcr
- ☐ ☒ should priority have more than 1 bit: join disabled/enabled?  
#10 opened on Nov 24, 2021 by mcr
- ☐ ☒ -05 Section 3.1, questions  
#7 opened on Aug 31, 2021 by dbarthel-ol
- ☐ ☒ explain how new option values are related to DODAGVersionNumber  
#5 opened on Aug 10, 2021 by mcr
- ☐ ☒ enrollment priority option name  
#4 opened on Aug 10, 2021 by mcr

# Open Tickets

/ [rpl-observations](#) Public

[Issues](#) 3 [Pull requests](#) [Actions](#) [Projects](#) [Wiki](#) [Security](#) [Insights](#) [Settings](#)

Filters

☐ 3 Open ✓ 4 Closed

☐ [Parent Address MUST be empty in Transit Information for storing MOP](#)  
#10 opened on Mar 16, 2020 by nyrahul

☐ [Implications of using smaller lollipop counter window](#)  
#9 opened on Dec 12, 2019 by nyrahul

☐ [Path Control bits handling](#)  
#6 opened on Nov 12, 2019 by nyrahul

[mopex](#) Public

[Issues](#) 1 [Pull requests](#) [Actions](#) [Projects](#) [Wiki](#) [Security](#) [Insights](#)

Filters

☐ 1 Open ✓ 1 Closed

☐ [do-not-join-instance flag in RPL ext control option](#)  
#8 opened on Mar 31, 2021 by nyrahul

# AODV-RPL: draft-ietf-roll-aodv-rpl-13

- MOP=4 => The Same MOP as RFC6997 (P2P-RPL, Experimental)
- AODV-RPL intended to replace P2P-RPL, going **Standards Track**
- Ben's ballot was DISCUSS, now ABSTAIN.
- Recent reviews by Pascal and Konrad. Huge thanks!
- All documented in tickets on Github
- Level of Interest in the WG to work on this topic?
- One known implementation, last update 2016
  - [https://github.com/lavanyahm/AODV\\_P2P\\_RPL](https://github.com/lavanyahm/AODV_P2P_RPL) (2016)

Destination Advertisement Object (DAO) control message of RPL. AODV-RPL uses the "P2P Route Discovery Mode of Operation" (MOP == 4) with three new Options for the DIO message, dedicated to discover P2P routes. These P2P routes may differ from routes discoverable by native RPL. Since AODV-RPL uses newly defined Options, there is no conflict with P2P-RPL [RFC6997], a previous document using the same MOP. AODV-RPL can be operated whether or not P2P-RPL or native RPL is running otherwise. For many networks AODV-RPL could be a

<input type="checkbox"/>	🕒 5 Open ✓ 0 Closed
<input type="checkbox"/>	🕒 Clarification needed to describe the differences with P2P-RPL #5 opened 29 seconds ago by inesrob
<input type="checkbox"/>	🕒 Review draft-ietf-roll-aodv-rpl-12 by Konrad #4 opened 3 days ago by inesrob
<input type="checkbox"/>	🕒 Review of draft-ietf-roll-aodv-rpl-13 by Pascal #3 opened 3 days ago by inesrob
<input type="checkbox"/>	🕒 draft-ietf-roll-aodv-rpl-11 review by Ben (DISCUSS ballot) #2 opened on Nov 10, 2021 by inesrob
<input type="checkbox"/>	🕒 draft-ietf-roll-aodv-rpl-10 review by John Scudder (DISCUSS) #1 opened on Nov 1, 2021 by inesrob

# Root initiated routing state in RPL

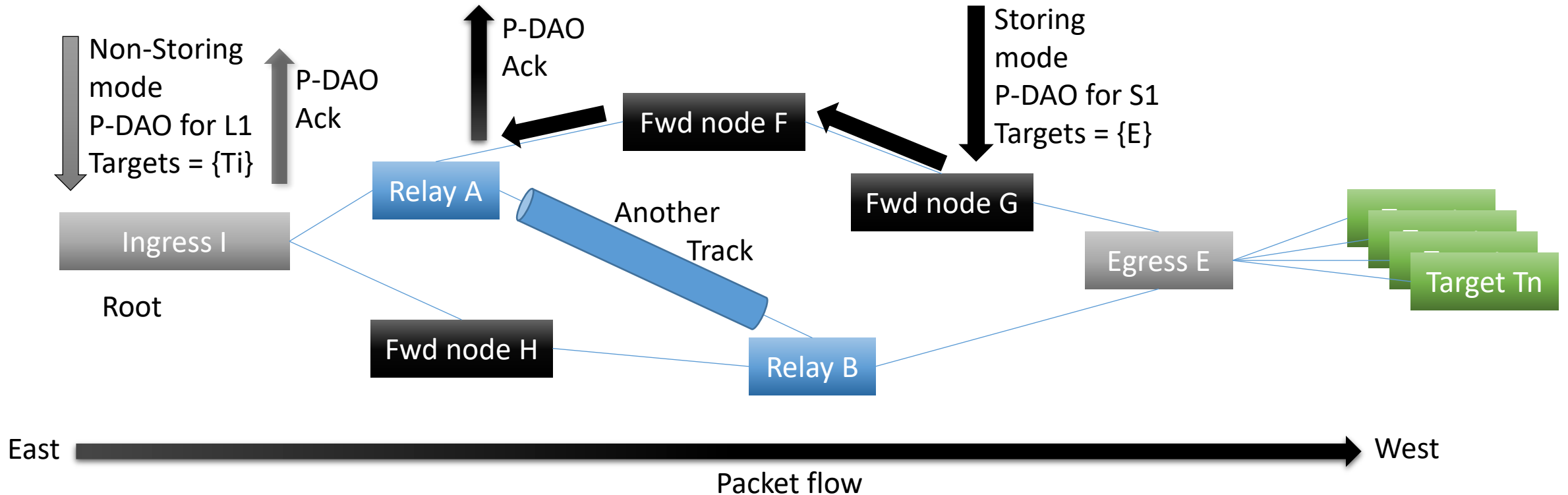
`draft-ietf-roll-dao-projection`

Pascal Thubert, Rahul Arvind Jadhav, Michael Richardson

IETF 113

Presenter: Pascal Thubert, remote.

# 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  $\subset \{L1, L2, L3\}$  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

# Status of the draft

- Latest rev is [draft-ietf-roll-dao-projection-24](#)
- 21: Includes IOT-DIR review by Toerless (before IETF 112)
- 22: Michael's review
  - Terminology (stretch, Tracks, ..)
  - Clarification (Building Tracks...)
  - Loose source routing benefits
  - New flag 'D' in DODAG conf option to signal "Projected Routes Support"
  - Mapping to DetNet:
    - Relay Nodes as the hops of a Leg
    - Forwarding Nodes as the hops in a Segment that join the Relay nodes



# Status of the draft (cont.)

- -23: Li's review, first round with questions left opened
  - Clarifications
  - Introducing P-DAO ACK
  - Introducing the bidirectional flag in Sibling Info Option (SIO)
- -24: More of Li's review, treated as GitHub issues
  - Allows more than one target options, will reach 1<sup>st</sup> + undefined subset.
  - Use of the bidirectional flag in Sibling Info Option (SIO) / what if dup
  - Michael's edits on Amends and Extends. Michael becomes co-author
- Since: Rephrasing terminology on Legs and SubTracks
  - Legs are loose hop sequences from Track Ingress to Egress
  - SubTracks (of a Track) are collections of Legs of the Track

# Next

- Remous-Aris' Review
  - Items ...
- WGLC; please consider:
  - Need for new status codes
  - Missing flows, e.g., Error flows

# Controlling Secure Network Enrollment in RPL Networks

draft-ietf-roll-enrollment-priority-06

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Michael Richardson [mcr+ietf@sandelman.ca](mailto:mcr+ietf@sandelman.ca)

IETF113, March 23 2022

# The Story So Far

- Behaviour assumed in RFC9032
- Document Adopted March 2020
- Merged with draft-hushe-roll-dodag-metric after virtual interim meeting January 2021.
- Version -04 posted with merged document
- Reviews and Discussion Summer 2021
- Observation that changes to record interacts poorly with trickle, Summer 2021
- Proposal to not change rank in priority field, allow only DODAG root to set it only.
- But, this fails to satisfy desire to balance where nodes join in the tree.
  - new lollipop counter proposed as solution?

# Still open Issues

- Trickle timer means that DIOs are not sent if there is no topology change.
  - So would changes to min priority be considered a change?
  - The DODAG size field could change quite often, particularly during network formation, how should it be dealt with?
- If updated min priority does not reset Trickle Timer, then this option needs to go into some new flooded control.
  - What are the desired properties of this new control, and what other things should go into it?
- New lollipop counter proposed to deal with changes
  - Alternatively, split up extension into two new extensions?

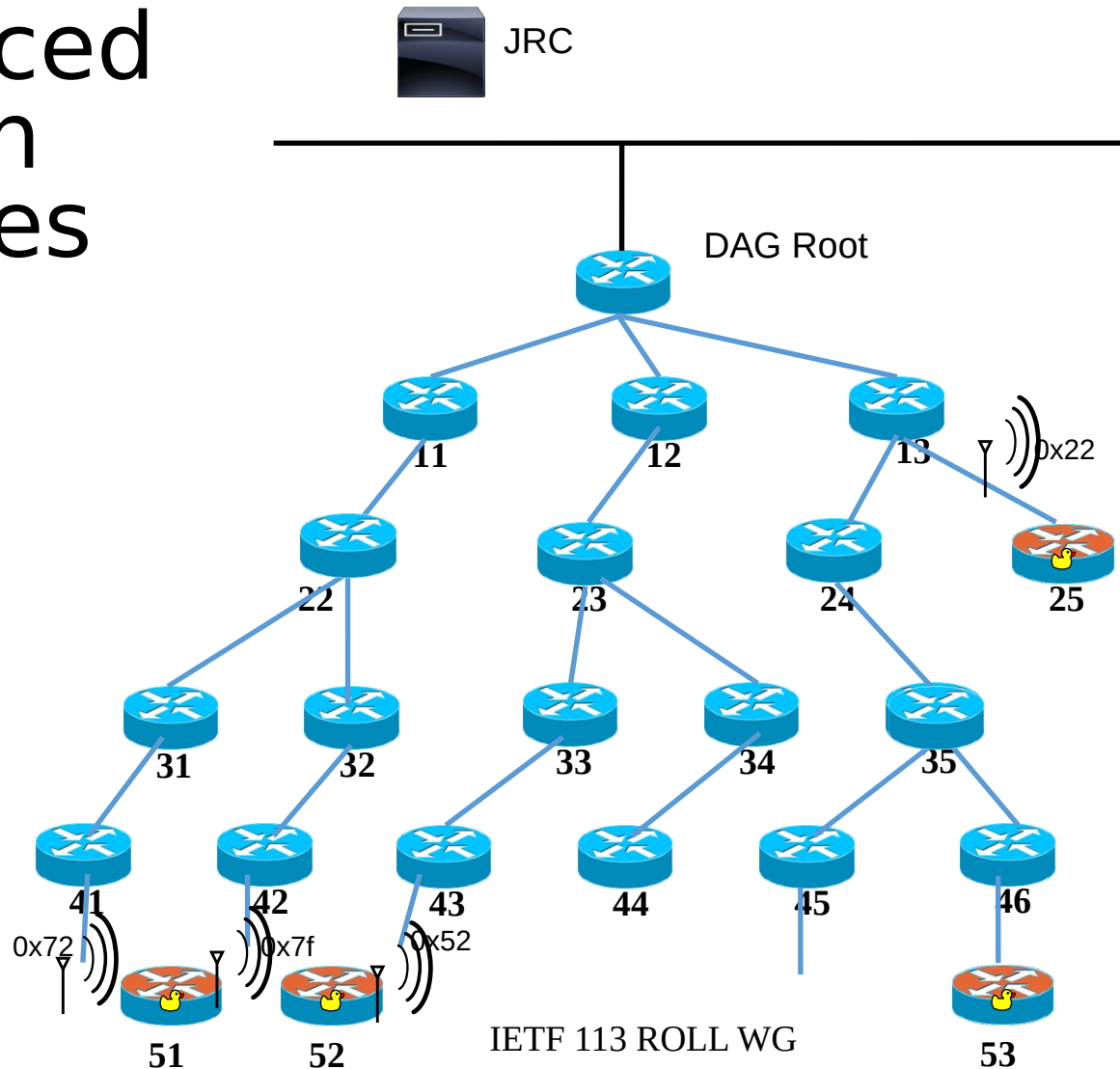
# Discussion!

## draft-ietf-roll-enrollment-priority-04



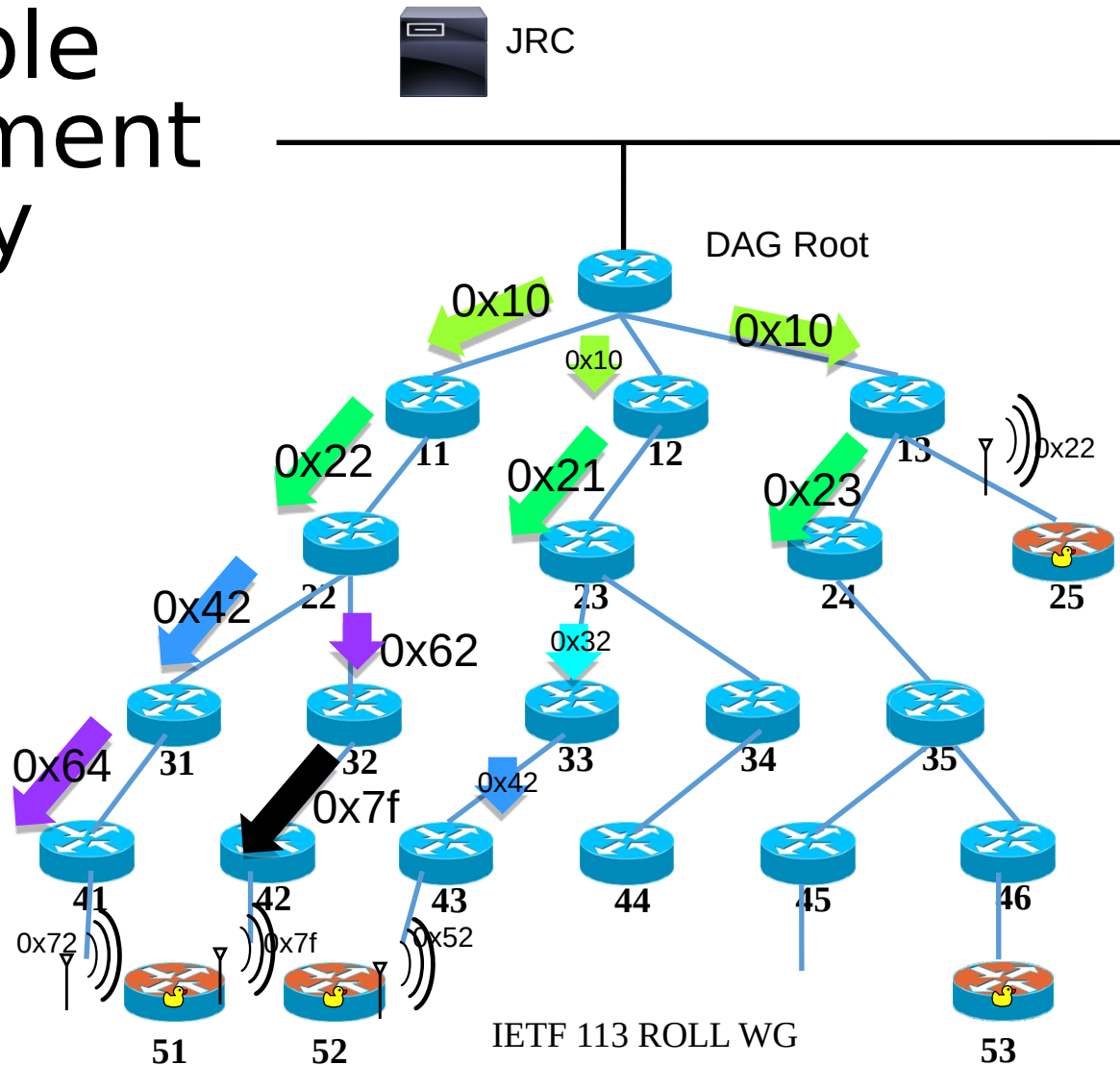
Auxiliary Slides Follow

# Enhanced Beacon Samples



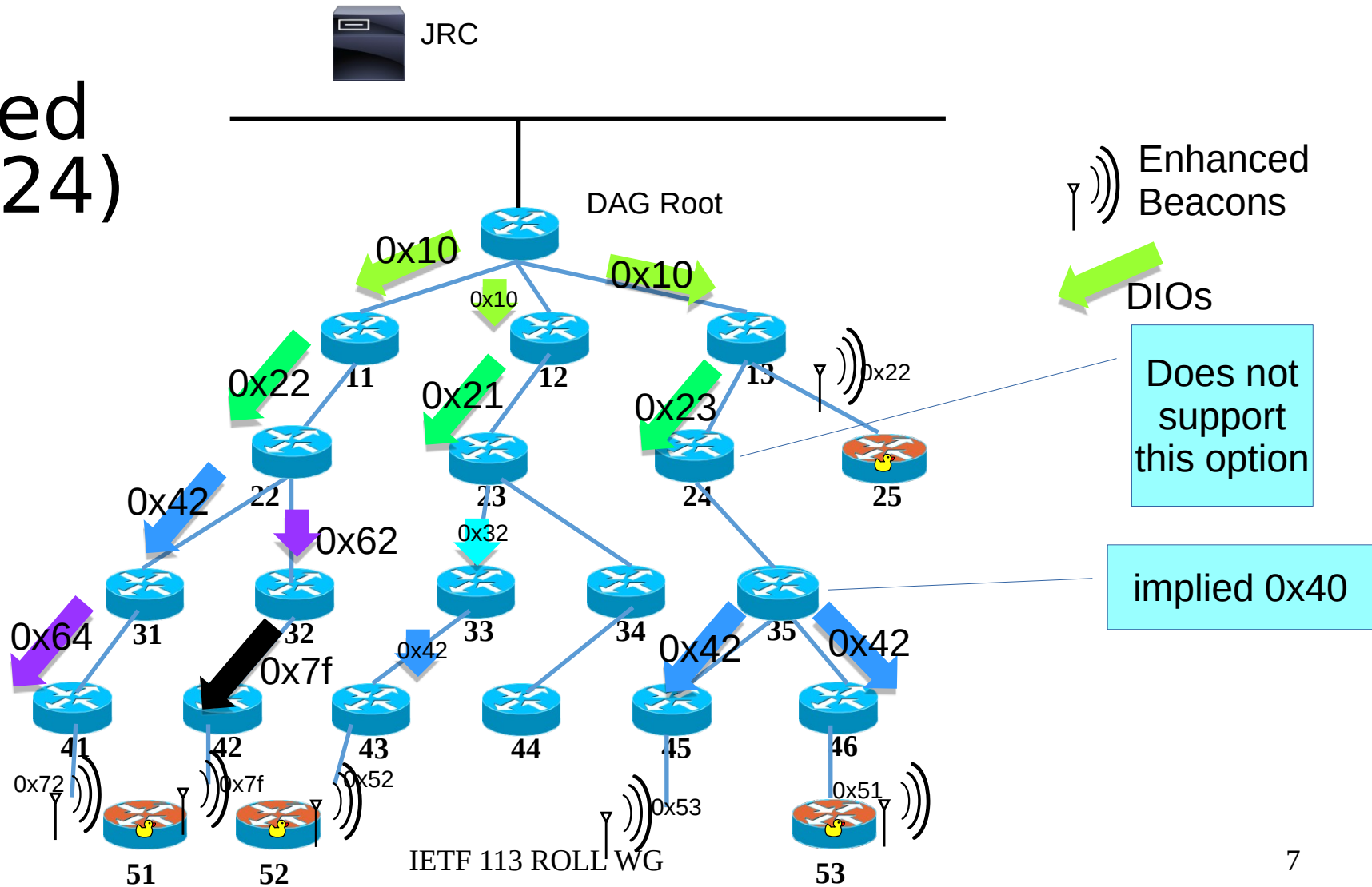
Enhanced Beacons

# Example enrollment priority





# With impaired node (24)



# IPv6 Neighbor Discovery Multicast Address Listener Registration

`draft-ietf-6lo-multicast-registration`

Pascal Thubert

IETF 113

Remote

# 6LoWPAN ND (IPv6 Stateful Address Autoconfiguration)

- [RFC 6775](#) (original 6LoWPAN ND)
  - Defines ARO for registration and DAD operations for stateful AAC
- [RFC 8505](#) (extended 6LoWPAN ND)
  - Extends ARO, updates the registration procedure
  - Allows registering to network services inc. proxy
- [RFC 8928](#) (Address Protection for ND)
  - Secures ownership and enables SAVI
- [RFC 8929](#) (Backbone Router – proxy ND)
  - Defines a proxy ND operation. Updates EDAR to transport ND options such as SLLAO.
- [draft-thubert-6lo-unicast-lookup](#) (Unicast Address lookup on backbone)
  - Allows the 6LBR to respond to lookups and saves broadcasts
- [draft-ietf-6lo-multicast-registration](#) (Anycast and Multicast Address Registration)
  - Registers anycast and multicast addresses (in addition to unicast per RFC 8505)

# draft-ietf-6lo-multicast-registration

- Generated as a response to a request from Wi-Sun alliance
  - Remove the need for MLD, and its reactive broadcast REPORT polling
- Extends RFC 8505
  - New flags in the EARO to signal anycast and multicast
  - 6LN operation virtually unmodified, just setting the flags
  - New 6LR behavior that accepts multiple registration with different ROVR
- Extends RFC 9010 (RPL Unaware Leaves)
  - To inject the anycast and multicast addresses in RPL, with new flags
- Extends RFC 6550
  - New MOP for Non-Storing Multicast (MOP 5?), new DAO / RTO flags
  - New anycast support also in Storing Mode Multicast (MOP 3)

# Changes in [draft-ietf-6lo-multicast-registration](#)

- Since IETF 112
  - Bumped from 02 to 04
  - Implicit registration of FF02::1 (-04)
  - How RFC 8928 is leveraged to secure addresses (-03)
  - Aligned draft-thubert-bess-secure-evpn-mac-signaling
- During IETF 112
  - Legacy anycast support and backward compatibility (-02)
  - Repurposing EDAR “status” field to carry A and M flags (-02)

# New Non-Storing Multicast Mode of Operation

- MOP (?5) => manage collision with AODV-RPL
- 6LRs with listeners register the multicast and anycast address to the Root
  - New flags in DAO messages echo those in EARO
- Packets reach up to the Root as if unicast within the DODAG
- The Root performs Ingress Replication for multicast
  - to all the 6LRs that registered
  - Same encapsulation as external routes (RUL), SRH to the 6LR
  - 6LR decapsulates and distributes to all 6LNs that subscribed (new term)
- The Root performs Destination Selection for Anycast
  - Passes the anycast packet to only one 6LR

# New RPL Anycast Operation

- For MOP 3 and the new MOP (?5), also MOP 1 for backward compatibility
- Indistinguishable from anycast, applies to both addresses and prefixes
- TID is irrelevant since multiple nodes can originate an advertisement
  - Multihomed mobile target should be advertised as unicast
- RPL advertises multiple paths as for multicast
  - A tree in Storing Mode, multiple paths at the Root in NS-mode
- But a packet follows only one of those paths
- No instruction for flow stickiness and load balancing given
- In case of collision (flag set / not set) consider all DAOs as anycast

# Backward compatibility and deployment considerations

- Discusses interaction with other multicast protocols
  - e.g., Root performing MPL flooding instead of RPL Ingress Replication
- Allows single DODAG with MOP 1 for brown field
  - Support of multicast / anycast must be signaled otherwise (config, mgt)
  - 6LRs that support this spec signal so with 6CIO
- Incremental operation in DODAG with MOP 3
  - MOP 3 (Storing Mode with Multicast) extended to accepted anycast
  - Recognize legacy DAO multicast from address FF::/8 assume M flag set
  - Anycast / unicast collision is processed as anycast for all



# Next steps

- Missing items?
- Getting a rough green light from this group
- Passing the token to ROLL for validation there as well

**AOB?**

Thank you very much for your attention