The Direction Field in Routing Metric/Constraint Objects Used in RPL
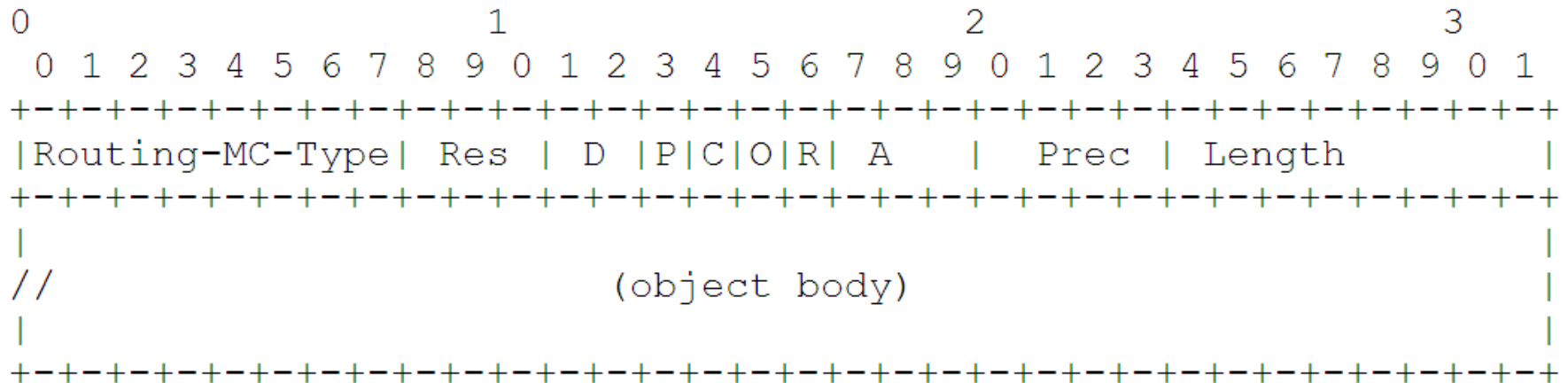# draft-goyal-roll-metrics-direction-00

Mukul Goyal
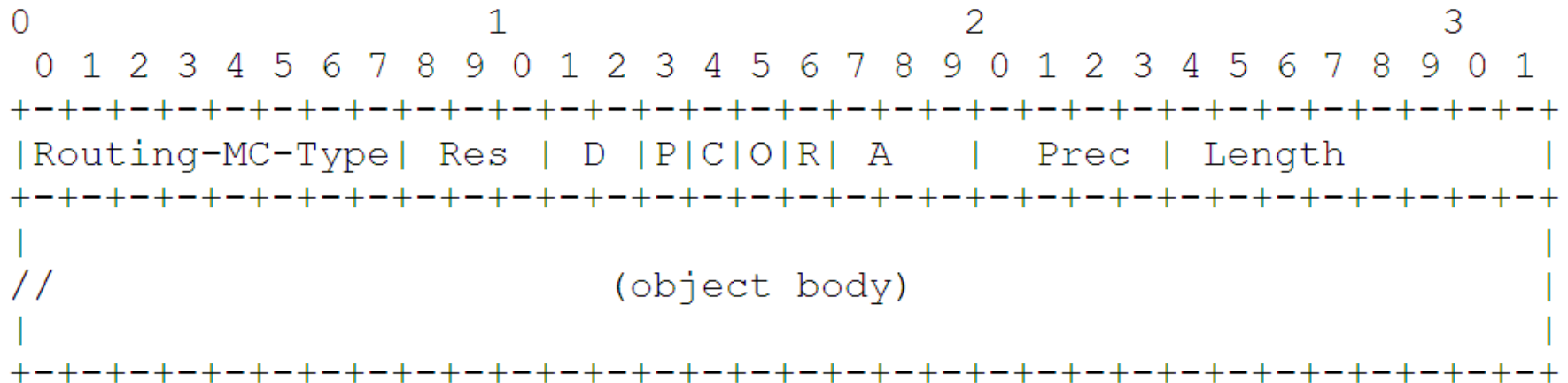
University of Wisconsin Milwaukee

Introduction

- Asymmetric links are a common observation in LLNs.
- Many link-level routing metrics have a directional aspect.
- Not always desirable to calculate a link-level metric in bidirectional manner. For example,
  - if a DAG is built for low latency communication to the DAG root, the link latency must be measured in Up direction
  - if a temporary DAG is being constructed to discover a point-to-point route towards a destination, the routing metric must be measured in Down direction.
- Useful to specify the directional aspect within the routing metric/constraint.

The Direction Field

```
0                   1                   2                   3
 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
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|Routing-MC-Type| Res | D |P|C|O|R| A   |   Prec | Length      |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                                                              |
//                       (object body)                        |
|                                                              |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

- This document defines a Direction field inside the Routing Metric/Constraint object header in two previously reserved bits.

- The modified Routing Metric/Constraint object header is backward compatible with its definition in [I-D.ietf-roll-routing-metrics].

The Direction Field

```
 0                   1                   2                   3
 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
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|Routing-MC-Type| Res | D |P|C|O|R| A   |  Prec  | Length       |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                                                              |
//                        (object body)                        |
|                                                              |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

- The Direction field is a 2-bit field that indicates the direction associated with the routing metric/constraint:
  - D = 0x00: undefined
  - D = 0x01: Up
  - D = 0x02: Down
  - D = 0x03: Bidirectional.
- If the D field has value 0x00, the direction associated with the routing metric/constraint is undefined as in [I-D.ietf-roll-routing-metrics].
- A value 0x00 for the D field may be suitable for node-level routing metrics/constraints.

Rules associated with D field

- A routing metric/constraint object MUST be measured/ evaluated in accordance with its D field value if defined.
- In case, an RPL node can not measure/evaluate the routing metric/constraint object in the specified direction, the following rules MUST be applied:
  - If the object is a recorded metric, i.e., has C=0 and R=1 fields, the RPL node MUST set the P flag inside the object, thereby indicating the partial nature of the recorded metric.
  - If the object is an aggregated metric, i.e., has C=0 and R=0 fields, the RPL node MUST drop the DIO containing the object.
  - If the object is a mandatory constraint, i.e., has C=1 and O=0 fields, the RPL node MUST drop the DIO containing the object.
  - If the object is an optional constraint, i.e., has C=1 and O=1 fields, the RPL node MAY drop the DIO containing the object or it MAY continue processing rest of the DIO ignoring this object.