DLEP for RAW

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What is DLEP?

- Dynamic Link Exchange Protocol (DLEP)
  - RFC 8175, Standards Track.
  - Developed for Mobile Ad-hoc Networks, in the MANET WG, but applicable elsewhere.

- A monitoring protocol that runs between a *Router* (Layer-3 device) and a *Modem* (Layer-2 wireless device)
  - It is not an “over the air” protocol; that is the domain of the link-layer technology.
  - But it allows the link-layer information to be passed ‘up’ to the IP layer.

- Increasing adoption by radio and network device vendors since publication.
  - Now being specified as a requirement in large government contracts in US and EU. IETF Standard, avoiding vendor lock-in, etc.

What does DLEP provide?

- DLEP provides the following information:
  - *Reachability*: What 'destinations' are currently reachable via the link-layer?
    - Includes Unicast and Multicast, keyed by MAC address.
    - Can include Layer-3 information, e.g. IPv4 addresses and routes, to avoid unnecessary ARP/ND and/or act as a basic route sharing mechanism.
  - *Capability*: What are the characteristics of the logical link between the current node, and a reachable destination, e.g.:
    - Current raw data-rate for Tx/Rx, allowing for asymmetric links.
    - Latency. *<- This is very relevant for RAW*.
    - Theoretical maximum raw data-rate for Tx/Rx, e.g. 11 Mbps for 802.11b.
    - Resources available at the destination.
    - Relative Link Quality, a percentage heuristic.
    - MTU.

Note: In DLEP a 'destination' is a device attached to a remote terminal, rather than the remote modem itself. In the case of multicast destinations, it is the set of all reachable destinations participating in the multicast group.

DLEP is Dynamic

- The clue is in the name :-)

- DLEP is session-based, and provides information dynamically throughout a session lifetime.
  - Event-driven protocol provides timely information, avoiding the need to repeatedly poll SNMP or other management API.

- Link capabilities are intentionally defined in terms that make sense at Layer-3, e.g. Data-rate in bps rather than symbol rate, as the target audience of the metrics is a Layer-3 device.
  - This abstracts the modem implementation detail, avoiding every router having to understand how to map radio-signal metrics for modem type *X* into IP packet throughput.

DLEP Extensions

- The protocol is extensible, with extensions negotiated at session establishment.

- Extensions exist (or are being developed):
  - Handling modems that operate at Layer-3.
  - Flow-control using credit-windowing
  - Reporting on multiple traffic flows individually, by DSCP, 3-tuple, etc. *This is of interest to RAW.*
  - Radio signal properties, e.g. SNR, BER.
  - Rendezvous-point selection preference, i.e. does the underlying link-layer topology suggest good rendezvous points?

DLEP + RAW

- In the proposed RAW architecture, a *Path Selection Element* (PSE) attempts to maintain the ‘tracks’ defined by the *Path Computation Element* (PCE), using knowledge of the local wireless environment.
  - When there is no underlying deterministic (TSN) capability provided by the link-layer.

- DLEP can provide a generic mechanism for a PSE to monitor the wireless environment.
  - Implementations exist using DLEP information to increase stability in MANETs.
  - It seems a logical next step is to use DLEP information to increase determinism in wireless networks.
    - DetNet over MANET seems unfeasible, but in reasonably controlled wireless environments… this sounds like RAW.

Link Characteristics Request

- DLEP has an additional (and under used) function: The *Link Characteristics Request*.

- This function allows a Router to request a change to the capabilities of a link between itself and another destination.
  - The Modem may refuse, if prevented by configuration or the laws of physics.

- This mechanism may be extremely useful in a RAW context when attempting to ‘pin down’ deterministic tracks.

Next Steps

- Do we want to add a section to the technologies draft?
  - I don’t think this warrants a draft in it’s own right
- Do we wish to draft a DLEP extension addressing deterministic capabilities?
  - Allow a wireless system to advertise TSN function?

References

- DLEP:
  - https://tools.ietf.org/html/rfc8175
- RAW technologies draft:
  - https://datatracker.ietf.org/doc/draft-ietf-raw-technologies/
- RAW architecture draft:
  - https://datatracker.ietf.org/doc/draft-pthubert-raw-architecture/

Questions?