BP Quality of Service

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BP QoS concepts

- The fundamental job of the bundle protocol agent is to forward bundles to topologically adjacent BP nodes.

- When multiple bundles are queued up for forwarding to a given node, how does the BPA decide which one to forward next?

- By default, the queued bundles are forwarded in FIFO order.

- QoS establishes an alternate algorithm for making this decision.

- QoS considerations:
  - Urgency, as declared by the BP user application
  - Assurance, as established by negotiated guarantee of transmit opportunity

Survey (1 of 3)

- The 0th-order solution: overprovisioning.
  - If every bundle presented to the BPA for forwarding is always forwarded immediately, then QoS is moot. The next bundle to forward is always the only one that is available for forwarding.
  - Of limited practicality.

Survey (2 of 3)

- QoS in the Internet:
  - Integrated Services (intserv)
    - Sender/receiver pair constitutes a flow.
    - RSVP is used to negotiate service reservation for that flow.
    - Does not easily scale.
    - Negotiation is not delay-tolerant.
  - Differentiated Services (diffserv)
    - The Differentiated Services Code Point (DSCP) value asserted in packet header – 6 bits – is used to select per-hop behavior.
    - Per-hop behavior parameters: priority under admission control, assurance of transmission (provided traffic rate is not exceeded), likelihood of packet drop when link is congested.
    - No guarantee that a given router will exhibit the requested behavior for a given packet.

Survey (3 of 3)

- QoS in Bundle Protocol version 6:
    - Class of service as defined in RFC 5050
        - Postal model: bulk, standard (first-class), expedited (express)
        - Processing is not defined.
        - Unlike postal service, marking a bundle "expedited" costs the user no more than "bulk"; service class selection is purely on the honor system.
    - Extended class of service (ECOS); Internet Draft prototyped in ION
        - "Ordinal" tag (fine-grained prioritization of expedited bundles)
        - Service selection flags: best-effort, reliable, critical
        - Numeric data label, usage undefined
        - Likewise on the honor system.

Granularity

- All QoS mechanisms discussed above assume no head-of-line blocking: a newly-received high-priority data unit can't be forwarded until in-process forwarding of the current data unit is completed.

- IP packets are so small (normally limited to 64KB) that this delay is insignificant.

- But all BP bundles are notionally jumbograms: any bundle's payload may be hundreds of gigabytes in length. Conformant BP traffic can easily defeat QoS.

- Yet we still need something.

A suggestion (1 of 2)

- Add a bundle processing flag indicating "QoS handling requested".

- Mandate that:
    - The QoS flag must be 0 if the length of the bundle's payload is greater than 65535 or the bundle is a fragment.
    - All bundles with QoS flag set to 1 must be forwarded before any bundles with QoS flag set to 0.

- Define a QoS extension block containing:
    - A numeric type-of-service request, comprising up to 32 ECOS-like flags
    - A numeric data label

A suggestion (2 of 2)

- Add an IANA registry of BP data labels.

- Define data labels and corresponding requested per-hop behavior in future RFCs.

- Let implementation of per-hop behavior be a node administration responsibility. No guarantees, as in diffserv.