Space Internet Workshop #5, DTN “birds of a feather” summary

- When the group convened, a list of questions about DTN was generated;
  - What is DTN?
  - What is the level of DTN standardization?
  - Why use DTN, when is it appropriate?
  - What are the downsides?
  - What alternatives exist?

SIW #5, DTN BOF, “What is DTN?”

- DTN is a store & forward mechanism for “bundles” of user data
- The “bundling protocol” supplies the queuing, routing and delivery semantics.
- Forwarding mechanism employs concepts of node names, endpoints within nodes, routes and links to form a network through which bundles move towards their destinations.
- DTN implementations are software but requires a degree of storage support for queueing.
- Useful in situations where end-to-end connectivity is unavailable.
- Requires reliable bundle transport protocols for reliable bundle transfers.
- Does not help manage the link scheduling problems found in space applications; DTN needs the same link link scheduling and management infrastructure that IP does.

SIW #5, DTN BOF, “What is the level of DTN standardization?”

- DTN rfc’s are in draft form.
- Bundle protocol seems well specified but additional pieces are either in progress or not yet addressed;
  - Bundle firewalls
  - Routing protocols to automate route generation and distribution.
  - QoS via bundle “flow labels” or something similar
  - Bundle encryption & authentication
  - Diverse transports; only TCP and LTP/AOS are known, some UDP support is in dtnrg implementation.
- DTN implementations are not known to interoperate with each other.

SIW #5, DTN BOF, “Why use DTN?”

- Bundling protocol is responsive to intermittent forward link connectivity.
  - Uniform model of address & routing spans incompatible networks.
- Seems a good fit to links between relay spacecraft; bundles queue at relays until next hop links come up.
- Relatively clean concept of node names, routes and links makes expressing topology straightforward.
- Protocol stack is relatively shallow; bundle protocol can operate on top of an IP stack as well as Layer 2.
- Offers well-defined queueing behavior when forwarding links are down
  - IP only drops packets in this case.
- DTN marketing is very good; lots of activity in DoD applications space.

SIW #5, DTN BOF, “Downsides of DTN?”

- Standards are relatively immature- lots of work going on but there is a lack of completeness as compared to the suite of IP rfc’s.
- Critical protocol features such as crypto, routing protocols, firewalls do not exist yet or are relatively new.
- Few implementations are known.
- Lack of extensive bundle transport mappings.
- Existing bundle transports are not known to interoperate between implementations.
- There is some concern that the DTN concept is collapsing traditional concepts of stack layering- if this is so then hidden scalability problems might manifest later.

SIW #5, DTN BOF, “Alternatives to DTN?”

- An alternative must have similar functionality;
  - Reliable transports are required
    - Data units can be sent as Reliable or Best Effort
    - MDP, CFDP, LTP, NORM can all be used for other app-layer protocols besides DTN.
  - Store and forward mechanisms must exist
    - SMTP is potentially a good match;
      - Mail queueing and addressing semantics are well-known.
      - Crypto & authentication mechanisms are well-known.
      - Large & multipart messages are well managed and widely supported via existing standards and practices.
      - “QoS” features like CC:, multiple To: addresses and priority are helpful in operational scenarios.
      - Message status replies up to and including delivery to end-user are well-defined.
      - Address space is IP, thus conformant to an end-to-end IP inter-network; no overlay concepts are needed. DNS is also not required.
      - Mail can be forwarded over a variety of transports, not just TCP. BSMTP over CFDP for example, can deliver quantities of messages over unidirectional links.
      - An extensive body of RFCs and implementations exists.