# Interplanetary Internet and HPR: Common Implementation Issues

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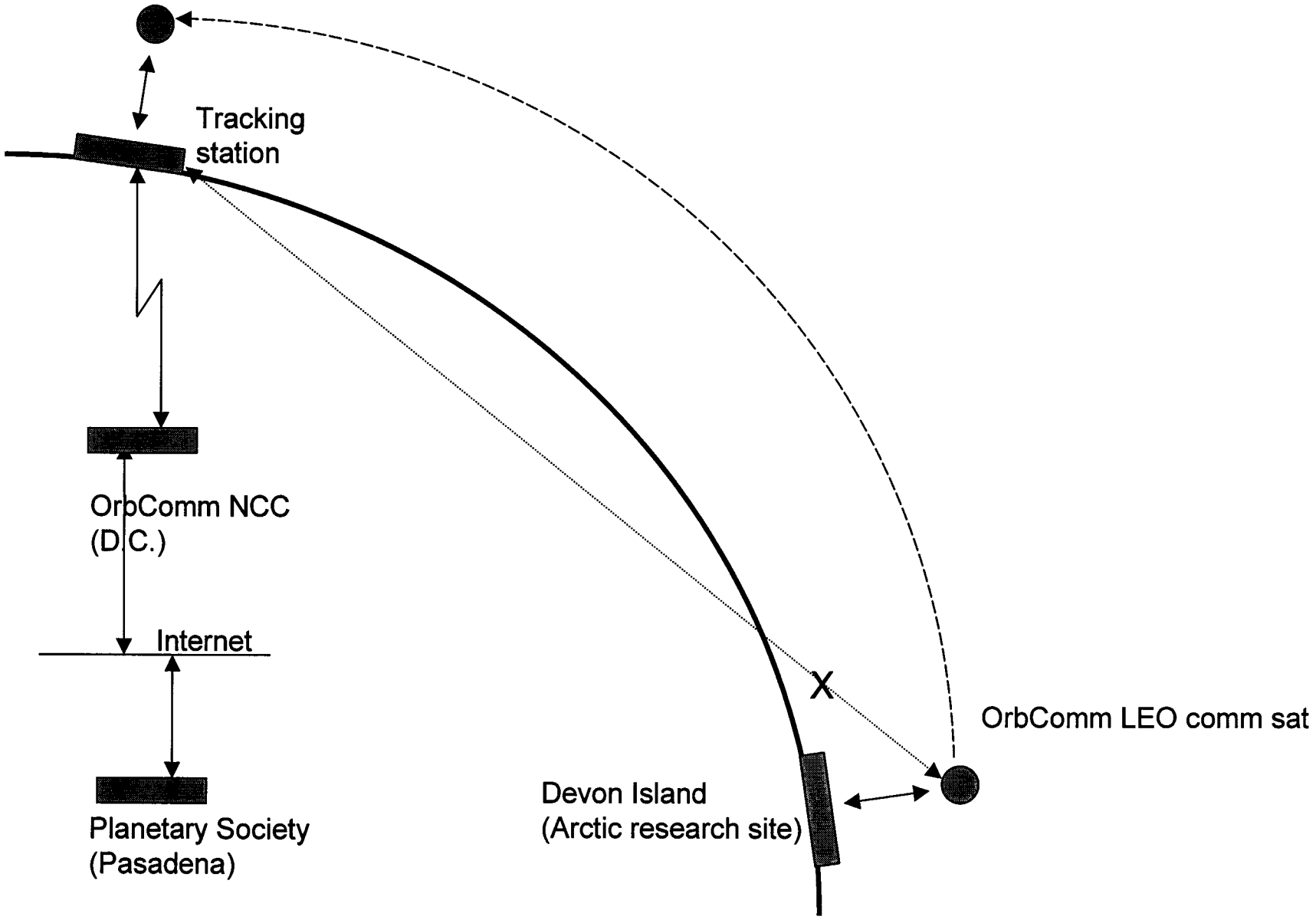
# Gaps in Infrastructure?

- Will HPR network be thin at the fringes?
  - Maybe there are extremely remote research sites: no fiber, no phone, no continuous satellite coverage.
  - In which case, no assurance of end-to-end connectivity at the time observations are taken.
- An example: SaamiNet (Lapland).
  - Remote Arctic settlements, no continuous connectivity ever.
  - But people on snowmobiles travel constantly among communities.
  - So install wireless-equipped computers on snowmobiles, run store-and-forward protocols. "Bundles" are stored in hard disk while snowmobiles are en route, forwarded when snowmobiles come within range of base stations.

# Gaps: another example



# Security?

- Gaps in infrastructure imply need for delay tolerance.
- Delay tolerance constrains security architecture.
  - No real-time key exchange (e.g., IKE).
  - No Diffie-Hellman traffic key negotiation.
  - No real-time certificate verification.

# Security (cont'd)

- Instead, maybe something like PGP or S/MIME.
  - Sender generates own public-private key pair, authenticates self to a trusted certificate authority, receives signed certificate containing public key.
  - Sender encrypts message in symmetric key, encrypts symmetric key in private key, attaches signed certificate to first message sent to receiver.
  - Receiver examines signed certificate, extracts public key, can from then on decrypt messages' symmetric keys – and thus message contents.

# Traffic Spikes?

- A definition: a “traffic spike” is a sudden, transient increase in the ratio of bandwidth demand to supply.
- One way to get a traffic spike is to increase transmission. But another is to reduce available bandwidth.
- So a network outage – reduction of available bandwidth to zero – is a weird kind of traffic spike.
- IPN protocols have to handle frequent, lengthy network outages by buffering outbound traffic. So they have a built-in tolerance for spikes as well.
- Might be useful for Public Warning applications.