

Slide 6

- **Network & Physical Layer**
 - ●Bundle protocol with unique IDs, TTL, and expiration handling
 - ●RF link modeling: SNR, path loss, Ka/Ku-band profiles, weather attenuation
 - ●Contact capacity derived from data rate × window duration

- **Routing Algorithms**
 - ●Epidemic (flood replication), PRoPHET (probabilistic), Spray-and-Wait (copy-limited)

- **Buffer Management**
 - ●Configurable sizes per node; drop policies: oldest-first, largest-first, random

- **Orbital Mechanics**
 - ●Keplerian propagation with ECI/ECEF conversion
 - ●Contact window prediction via satellite-ground visibility calculations

Slide 7

- **3D Interactive GUI**
 - ●Real-time satellite constellation on rotating Earth
 - ●Animated packet transfers (pulsing arcs on active links)
 - ●Contact Gantt charts and per-node buffer utilization bars
 - ●Ground station markers, run controls (start/stop/pause, time acceleration)

- **Live Metrics**
 - ●Delivery ratio, throughput, buffer utilization

- **Experiment Framework**

- ●E1: Protocol comparison | E2: Buffer size sweeps | E3: TTL configuration
- ●Preset endpoints for reproducible experiments