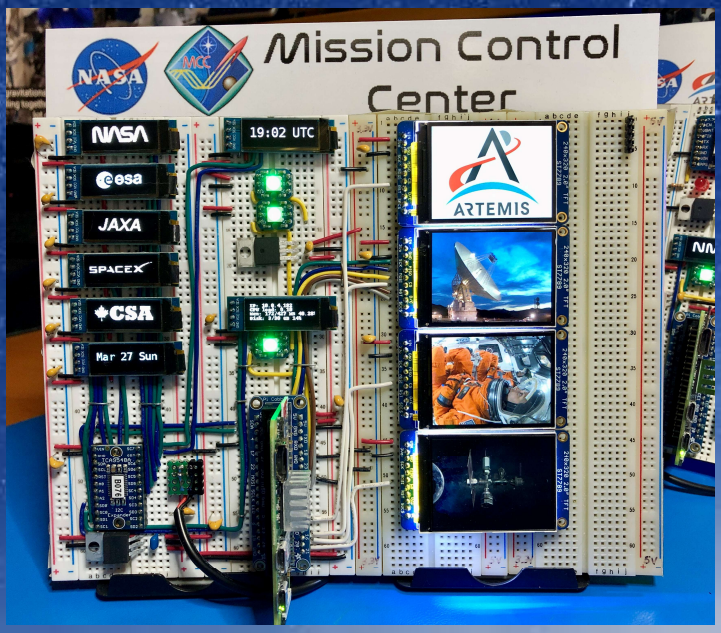
IPN-DTN Laboratory Prototype

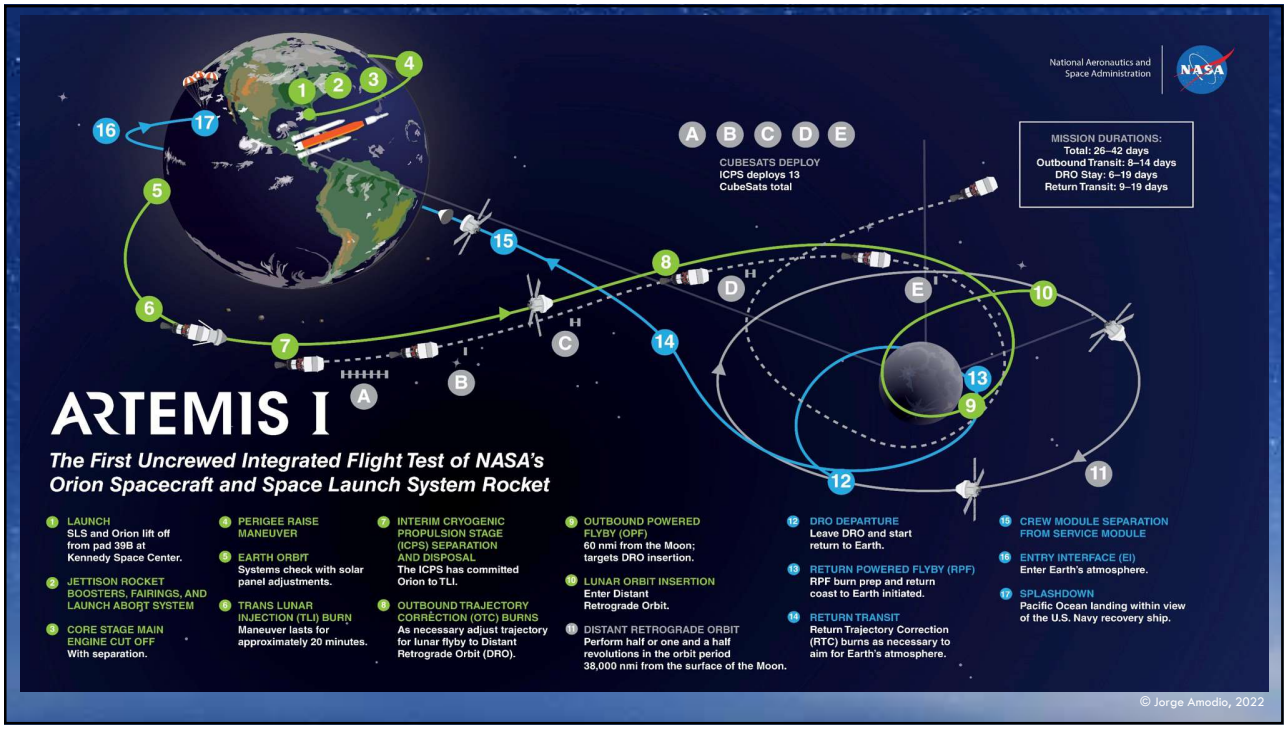


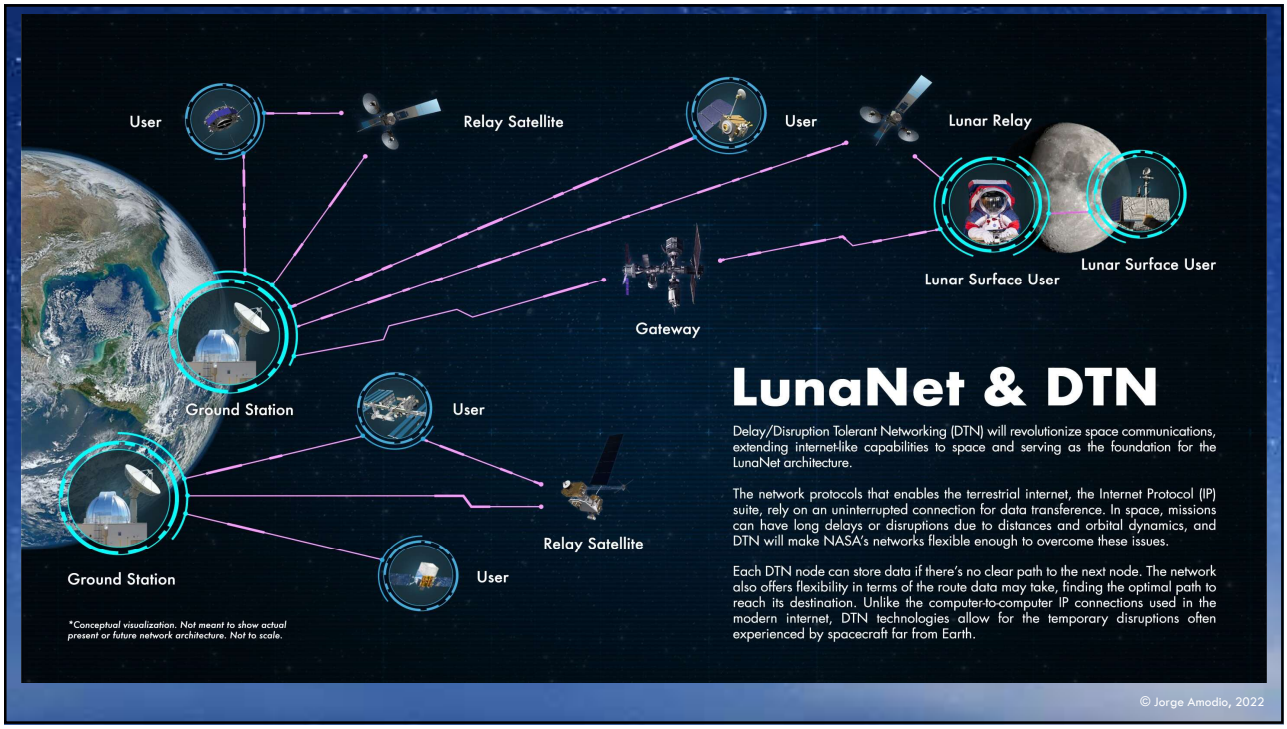
INTERPLANETARY NETWORKING

By Jorge Amodio
@jamodio

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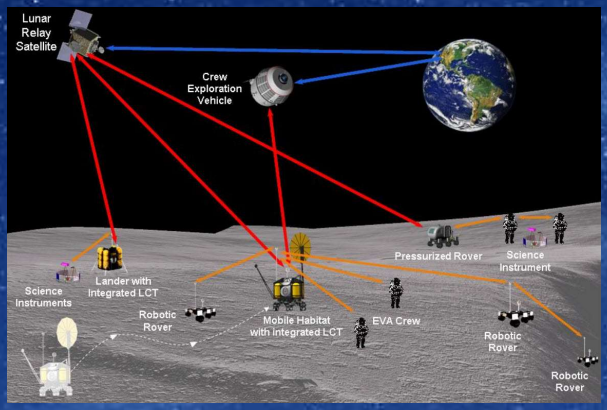

National Aeronautics and Space Administration
NASA
ARTEMIS I
The First Uncrewed Integrated Flight Test of NASA's Orion Spacecraft and Space Launch System Rocket
CUBESATS DEPLOY
ICPS deploys 13 CubeSats total
MISSION DURATIONS:
Total: 26–42 days
Outbound Transit: 8–14 days
DRO Stay: 6–19 days
Return Transit: 9–19 days
1 LAUNCH
SLS and Orion lift off from pad 39B at Kennedy Space Center.
2 JETTISON ROCKET BOOSTERS, FAIRINGS, AND LAUNCH ABORT SYSTEM
3 CORE STAGE MAIN ENGINE CUT OFF
With separation.
4 PERIGEE RAISE MANEUVER
5 EARTH ORBIT
Systems check with solar panel adjustments.
6 TRANS LUNAR INJECTION (TLI) BURN
Maneuver lasts for approximately 20 minutes.
7 INTERIM CRYOGENIC PROPULSION STAGE (ICPS) SEPARATION AND DISPOSAL
The ICPS has committed Orion to TLI.
8 OUTBOUND TRAJECTORY CORRECTION (OTC) BURNS
As necessary adjust trajectory for lunar flyby to Distant Retrograde Orbit (DRO).
9 OUTBOUND POWERED FLYBY (OPF)
60 nmi from the Moon; targets DRO insertion.
10 LUNAR ORBIT INSERTION
Enter Distant Retrograde Orbit.
11 DISTANT RETROGRADE ORBIT
Perform half or one and a half revolutions in the orbit period 38,000 nmi from the surface of the Moon.
12 DRO DEPARTURE
Leave DRO and start return to Earth.
13 RETURN POWERED FLYBY (RPF)
RPF burn prep and return coast to Earth initiated.
14 RETURN TRANSIT
Return Trajectory Correction (RTC) burns as necessary to aim for Earth's atmosphere.
15 CREW MODULE SEPARATION FROM SERVICE MODULE
16 ENTRY INTERFACE (EI)
Enter Earth's atmosphere.
17 SPLASHDOWN
Pacific Ocean landing within view of the U.S. Navy recovery ship.
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User
Relay Satellite
User
Lunar Relay
Lunar Surface User
Lunar Surface User
Gateway
Ground Station
User
Relay Satellite
Ground Station
User
*Conceptual visualization. Not meant to show actual present or future network architecture. Not to scale.
LunaNet & DTN
Delay/Disruption Tolerant Networking (DTN) will revolutionize space communications, extending internet-like capabilities to space and serving as the foundation for the LunaNet architecture.
The network protocols that enables the terrestrial internet, the Internet Protocol (IP) suite, rely on an uninterrupted connection for data transference. In space, missions can have long delays or disruptions due to distances and orbital dynamics, and DTN will make NASA's networks flexible enough to overcome these issues.
Each DTN node can store data if there's no clear path to the next node. The network also offers flexibility in terms of the route data may take, finding the optimal path to reach its destination. Unlike the computer-to-computer IP connections used in the modern internet, DTN technologies allow for the temporary disruptions often experienced by spacecraft far from Earth.
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ITN-DTN R&D and Education Lab Prototype



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ITN-DTN R&D and Education Lab Prototype

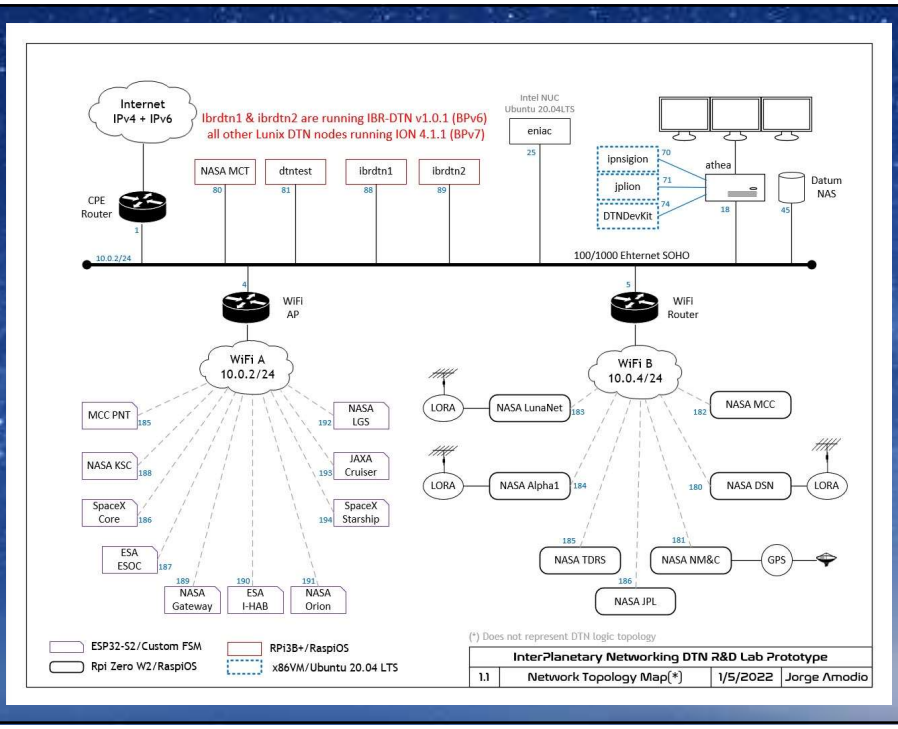
Features

- Low Cost
- Modular
- Off the shelf components
- Scalable architecture
- Open Source code and tools
- Multiple type of devices for learning how to code/interface with displays, sensors, etc.
- Flexible implementation for upgrades, expansion, testing, probing

ARTEMIS

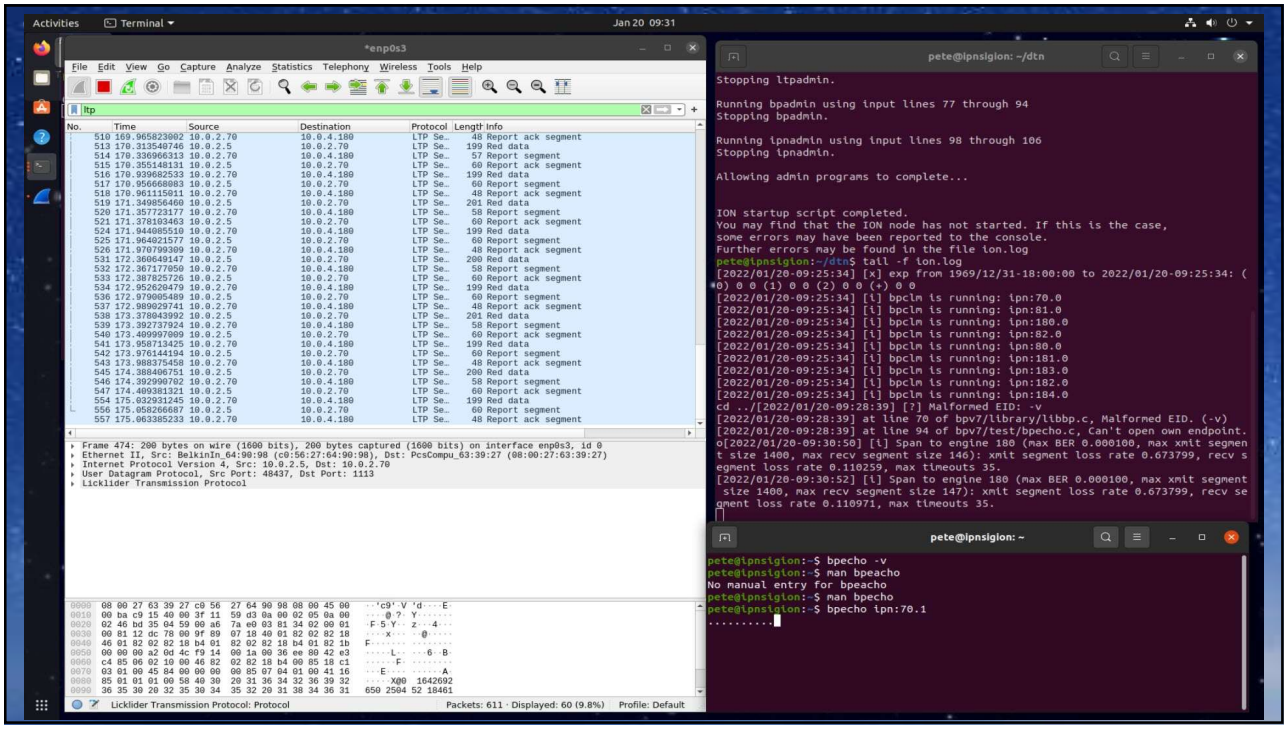
Current design for IPN-DTN Lab is inspired in the NASA Artemis Mission, using NASA's JPL, ION (Interplanetary Overlay Networking) DTN implementation

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NASA DSN
pete@nasa-dsn: ~/dtn
Stopping ionsecadmin.
Running ltpadmin using input lines 20 through 23
Stopping ltpadmin.
Running bpadmin using input lines 28 through 38
Stopping bpadmin.
Running ipnadmin using input lines 42 through 43
Stopping ipnadmin.
Allowing admin programs to complete...
ION startup script completed.
You may find that the ION node has not started. If this is the case,
some errors may have been reported to the console.
Further errors may be found in the file ion.log
pete@nasa-dsn:~/dtn $ bping -v -c 10 ipn:180.1 ipn:70.1
Sending 10 bundles from ipn:180.1 to ipn:70.1 (rpt-to: none) every 1.00 seconds
64 bytes from ipn:70.1 seq=0 time=1.828379 s
64 bytes from ipn:70.1 seq=1 time=1.574204 s
64 bytes from ipn:70.1 seq=2 time=1.675708 s
64 bytes from ipn:70.1 seq=3 time=1.312180 s
64 bytes from ipn:70.1 seq=4 time=1.450664 s
64 bytes from ipn:70.1 seq=5 time=1.322374 s
64 bytes from ipn:70.1 seq=6 time=1.297445 s
64 bytes from ipn:70.1 seq=7 time=1.422423 s
Sent 10 bundles.
64 bytes from ipn:70.1 seq=8 time=1.242731 s
64 bytes from ipn:70.1 seq=9 time=1.312834 s
receiveResponses done.
10 bundles transmitted, 10 bundles received, 0.00% bundle loss, time 19.3915 s
rtt min/avg/max/sdev = 1242.731/1443.894/1828.379/181.732 ms
pete@nasa-dsn:~/dtn $


Activities
Terminal
Jan 20 09:31
*enp0s3
pete@ipnsigion: ~/dtn
Stopping ltpadmin.
Running bpadmin using input lines 77 through 94
Stopping bpadmin.
Running ipnadmin using input lines 98 through 106
Stopping ipnadmin.
Allowing admin programs to complete...
ION startup script completed.
You may find that the ION node has not started. If this is the case,
some errors may have been reported to the console.
Further errors may be found in the file ion.log
pete@ipnsigion:~/dtn$ tail -f ion.log
pete@ipnsigion: ~
pete@ipnsigion:~$ bpecho -v
pete@ipnsigion:~$ man bpeacho
No manual entry for bpeacho
pete@ipnsigion:~$ man bpecho
pete@ipnsigion:~$ bpecho ipn:70.1

THANK YOU !!

Jorge Amodio
jpndtn@ljcv.net

https://about.me/jamodio
https://www.linkedin.com/in/jorgeamodio/

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