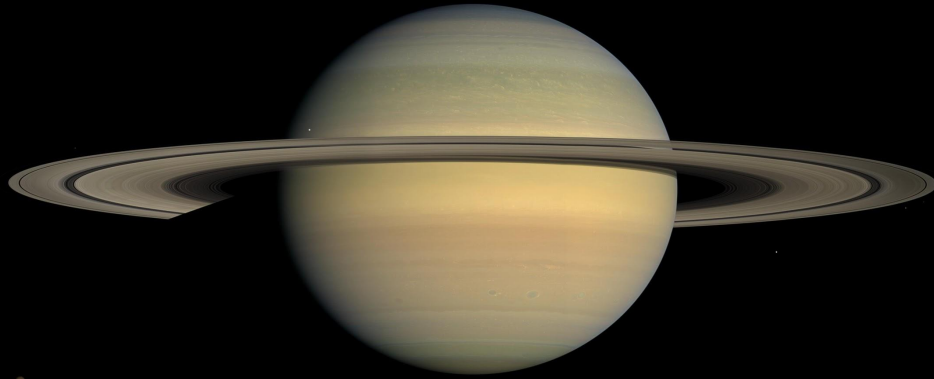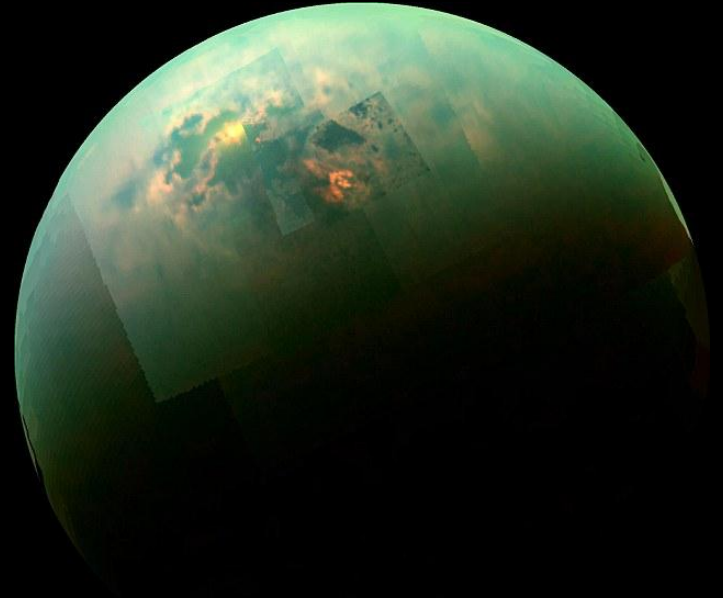# DS-FTP: Deep Space File Transfer Protocol

Presented by:
Connor Wool

Overview

- Introduction + Motivation
- Related Work
- Data structures + Messages
- Sending and Receiving
- Predictive Re-sending
- File Write Management
- Internet vs. Galaxy-net
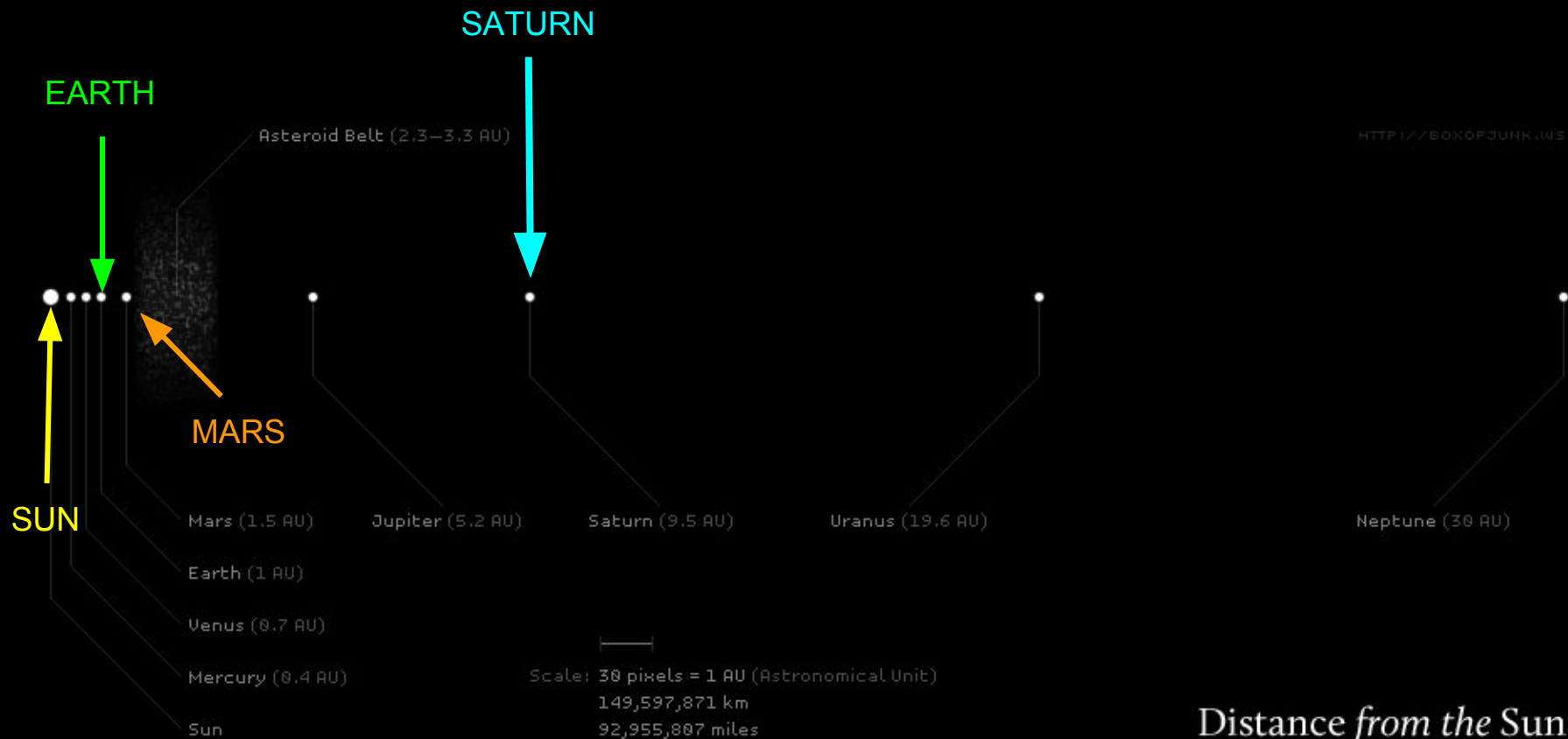- Conclusions + Future Work

Saturn, as seen by the
Cassini craft in 2008

Saturn's second-largest moon, Titan. Solid
surface, lakes of methane (rocket fuel) and
nitrogen-atmosphere

SATURN

EARTH

Asteroid Belt (2.3—3.3 AU)

HTTP://BOXOFJUNK.WS

MARS

SUN

Mars (1.5 AU)   Jupiter (5.2 AU)   Saturn (9.5 AU)   Uranus (19.6 AU)   Neptune (30 AU)

Earth (1 AU)

Venus (0.7 AU)

Mercury (0.4 AU)   Scale: 30 pixels = 1 AU (Astronomical Unit)
                                          149,597,871 km
Sun   92,955,807 miles

Distance *from the* Sun

Introduction and Motivation

The year is 2563, and "*Fast and Furious 482: Asteroid Drift*" just came out back on Earth. You want to watch it, but how can you get a copy?

- Saturn is 4,260 light-seconds (~71 light-minutes) away from the earth
- Propagation delay = 4,260 seconds
- RTT = 8,520 seconds (2 hours 22 minutes)
- How do we send an IP-based message back and forth?

Related Work (copies in github repo)

"*Deep Space Transport Protocol: A novel transport scheme for Space DTNs*", Papastergiou, Psaras, Tsaoussidis

"*A Reconfigurable Context-Aware Protocol Stack for Interplanetary Communication*", Peoples, Parr, Scotney, Moore
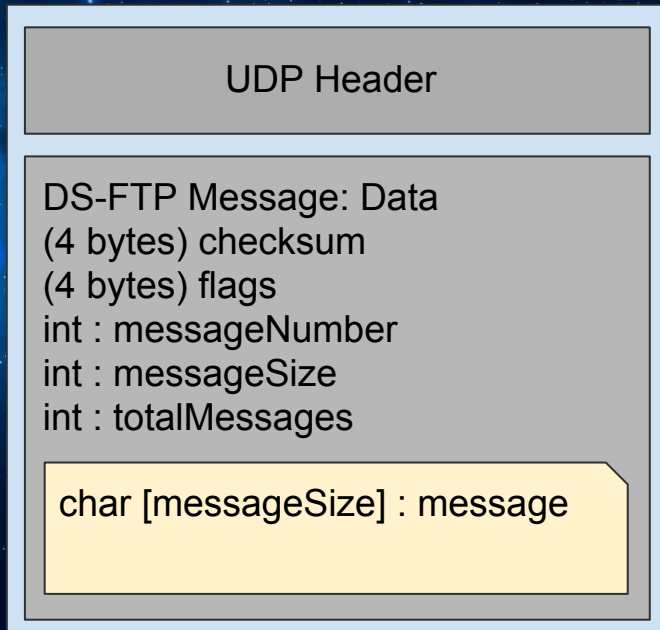
"*Space for Internet and Internet for Space*", Burleigh, Cerf, Crowcroft, Tsaoussidis

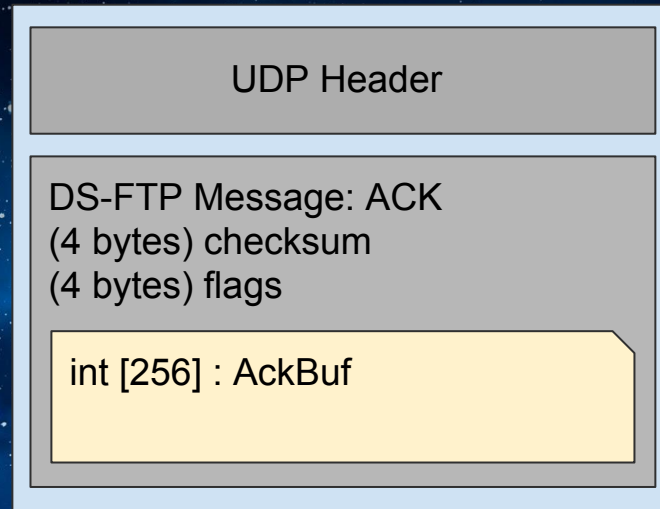"*The Interplanetary Internet implemented on a terrestrial testbed*", Mukherjee, Ramamurthy

"*Communication Technologies and Architectures for Space Network and Interplanetary Internet*", Mukherjee, Ramamurthy

Data Structures + Messages

Message Block

UDP Header

DS-FTP Message: Data
(4 bytes) checksum
(4 bytes) flags
int : messageNumber
int : messageSize
int : totalMessages

char [messageSize] : message

Ack Block

UDP Header

DS-FTP Message: ACK
(4 bytes) checksum
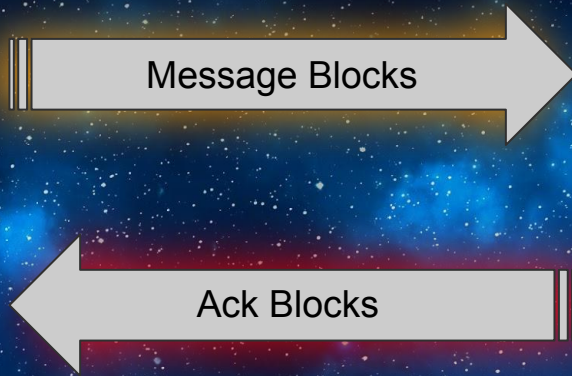(4 bytes) flags

int [256] : AckBuf

Sending and Receiving

Client (Sender)

1. Read data from file and create messages
2. Send messages into link with dynamic redundancy
3. Wait for Ack packets and re-requests

Message Blocks →

← Ack Blocks

Server (Receiver)

1. Listen for incoming messages
2. Write messages to file and mark in "messageTrackingTable"
3. Create AckBlock messages and send once 256 messages recieved or no messages recieved for 10 seconds

Predictive Re-sending

- The biggest enemy is dropped packets
- Instead of waiting for server to re-request packets, preemptively resend packets based on available bandwidth of link
- Could be implemented with NAT on the server side to cause extra packets to be dropped once connection is complete and server has closed port
- Server tracks message number associated with each packet, can identify duplicates

File Management

- Uses the <fcntl.h> library for binary-level read/write to files
- All messages except final message are of MSG_BLK_MAX_SIZE
  - Allows server-side process to seek through output file and arbitrarily write messages to their proper location in the final output file
- All messages have a "message size" field as a safeguard, server side uses this value to control # of bytes written to file

Internet vs. Galaxy-net

- What does this mean for the future of the Internet?
- Internet
  - A group of interconnected hosts running the IP protocol, for which the propagation delay from any host A to any host B is at most 30 seconds
  - Allows for high-orbit spacecraft and nearby objects (moons, satellites, Imperial Star Destroyers) to be a part of the local planet's Internet system
- Galaxy-net
  - A group of Internets connected by EM/Optical long-distance transmission links
  - Communicate via file-transfer
  - Replicate important files across links and store cache files locally in each Internet

Pull requests   Issues   Marketplace   Explore

connor-wool / **dsftp**

Unwatch ▾   1   ★ Star   0   ⑂ Fork   0

<> Code   ⓘ Issues **0**   ⑂ Pull requests **0**   ▦ Projects **0**   ▤ Wiki   ▥ Insights   ⚙ Settings

Deep Space File Transfer Protocol: a system for transferring files over interstellar distances. Uses UDP over IP to send packets along a link, and works to create reliable file transfers over propagation delays larger than 30 seconds.

Edit

Add topics

⑂ **4** commits   ⑂ **1** branch   ◇ **0** releases   ⚇ **1** contributor

Branch: master ▾   New pull request   Create new file   Upload files   Find file   Clone or download ▾

connor-wool updated gitignore   Latest commit 16cfee0 a minute ago

📁 bin	added compiled binaries to gitignore, fixed mk script	2 minutes ago
📁 docs	improved organization of files	9 minutes ago
📁 examples	improved organization of files	9 minutes ago
📁 source	improved organization of files	9 minutes ago
📄 .gitignore	updated gitignore	a minute ago

Help people interested in this repository understand your project by adding a README.   Add a README

Conclusions + Future Work

- Currently checksums are un-implemented (relying on link-level CRC)
- Current system only allows transfer of single file per connection
    - Add field for tracking which file a message is attached to, for constant stream of data between client and server