Game Theoretical Analysis of Resource Allocation in the InterPlanetary File System

David Grisham

TBD

Background

IPFS (InterPlanetery File System)

- P2P hypermedia distribution protocol
- Content-addressed, versioned filesystem
- Git repo in a torrent
- Many use-cases
  - **Goal:** Replace HTTP, decentralize Internet

IPFS Stack

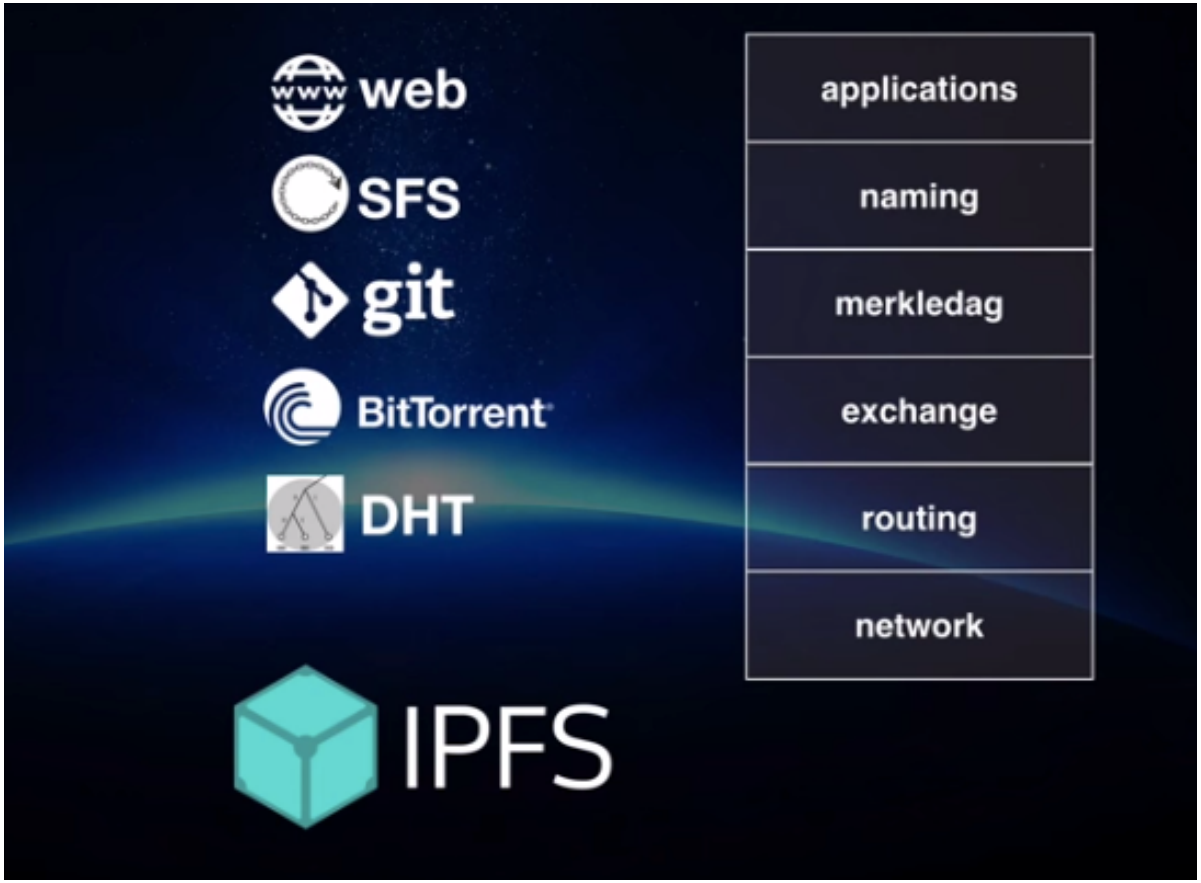

Figure 1: The IPFS Stack

Bitswap

- IPFS's block exchange protocol
- Inspired by BitTorrent
- *Given a set of peers who want data, how to allocate resources?*
  - Strategy function

Objectives

- Classify Bitswap strategy functions
  - Conditions where useful
- **Analytical work:** Repeated game model
- **Empirical work:** Simulations

Plan

Analytical Work

1. **Repeated game analysis**
   - Balance model accuracy with complexity
2. **Evolutionary game theory** (if time allows)
   - Good model, but high complexity

Simulations

1. **Strategy simulator**
   - Complements repeated game analysis
2. **Bitswap tests**
   - Test actual IPFS nodes

Progress and Preliminary Results

Strategy Simulator

- 3 node network
- Parameters
  - Resource distribution
  - Initial peer-wise reputations
- Tests whether given strategy function gives NE

TODO: full exchange example?

Repeated Game Analysis

- Verified results of strategy simulator
- Mathematica notebook
- Intractable for nontrivial strategy functions
  - **Next step:** Alternative functions/representations

Go-IPFS and IPTB

- Beta strategy-integration into `go-ipfs`
- IPTB: IPFS nodes in Docker containers
- Scripted tests

Timeline