Looking Ahead to Next-Generation Piracy

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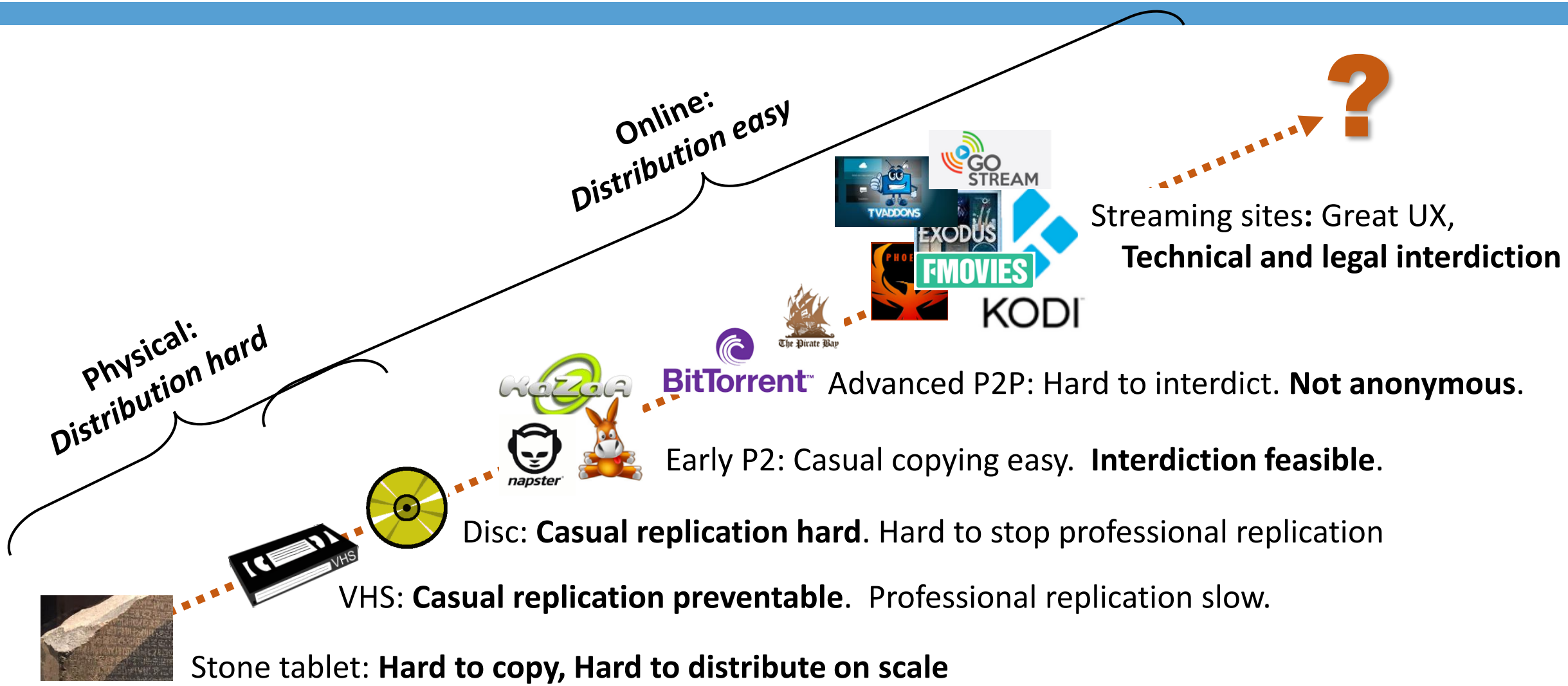
Piracy Technology evolution



Streaming sites: Great UX, **Technical and legal interdiction**

Advanced P2P: Hard to interdict. **Not anonymous**.

Early P2: Casual copying easy. **Interdiction feasible**.

Disc: **Casual replication hard**. Hard to stop professional replication

VHS: **Casual replication preventable**. Professional replication slow.

Stone tablet: **Hard to copy, Hard to distribute on scale**

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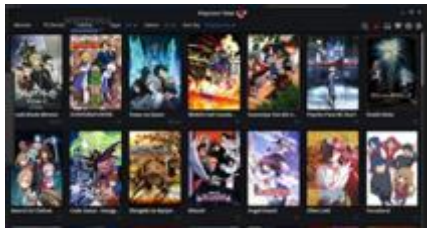
Hypothetical Piracy example/nightmare



- Front End UX – UX Matters!
  - Great content discovery UX
  - 10’, laptop and mobile
  - Website, plugins and app integration
  - Code base could be P2P w/anonymous developers (e.g., GitTorrent)
- Metadata Database
  - Curated – Trusted and reliable (but anonymous) curators
  - Reliable Streaming with fast startup
- Payments to uploaders, curators and node operators
  - Provides incentives
  - Cryptocurrency pseudo-anonymity makes tracing more challenging
- Uploader/downloader anonymity (safety)

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Technology Trends: Network

- IPv6: Many more addresses (2^{128} ~ 3.4×10^{38})
  - IP-based geo-filtering more challenging
    - IPV4-IPV6 translation will make it harder to geolocate—VPN or proxy-like behavior
  - Harder to isolate bad players
- Move to "Encrypt the Web" for Security and Privacy
  - IETF response to NSA surveillance disclosures
  - Determining bad behavior more difficult (who is talking and what are they saying)
  - For example: Encrypting SNI (Server Name Interface) and DNS (Domain Name Service)
- Virtual Private Networks (VPNs) – obfuscate identity and behavior
  - Used for security, avoiding national censorship, avoiding geolocation,
  - Anecdotally, U.S. network operator sees negligible adoption
  - In some territories, up to 30% use VPN at some time

IETF TLS Let's Encrypt QUIC IPVANISH VPN OPENVPN Invisible browsing VPN HIDE MY ASS!

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Technology Trends: AI and Payment

- AI and Machine Learning
  - Distinguish between real content and fake (false listings, spoofs)
  - Automate commenting/comment removal
  - Future battle of the piracy vs. anti-piracy bots?
- Cryptocurrencies facilitate monetization
  - Provide pseudo-anonymity
  - Could enable micropayments, super-distribution
  - Automatic Remuneration for providing or hosting popular content
    - Ethereum Smart Contracts
    - BitTorrent, Inc. bought to a blockchain company (Tron). Rolling out version the remunerates people for seeding

Technology Trends: Cloud Storage

- Current countermeasures
  - UGC sites: Upload filtering, Take-down/stay-down via ACR
  - Legit cloud storage without filtering and search: Automated take down notices
  - Non-responsive sites and cloud storage: Site blocking
- Potentially, services could encrypt content with keys unknown to the operator
  - Could services have zero-knowledge of content
  - However, for piracy, keys need to be easily and publicly available
    - Countermeasures could rely on those keys
- Poor cloud experience puts pressure on P2P evolution and vice versa

Technology Trends: Distributed Trust

- Piracy relies on anonymity, but quality demands trust
  - An individual or group with ‘reputation’
  - Stake (investment)
  - Algorithm
- Increased research on tamper resistance and ”trust” in distributed systems
  - Proof of Work, Proof of Stake in blockchain cryptocurrencies
  - Proof of Storage is anchoring distributed bit lockers
  - BitTorrent
    - DHT long and successful history as alternative to tracker servers
  - Curation and reputation
    - Proof of Upload and torrent popularity could anchor trust for curated content and metadata
    - Steem.io, Meta-moderation (slashdot)

Let's not forget: *Legitimate* access expanding

- Netflix, Amazon+, iTunes, Hulu, Sony Crackle, Tubi TV, …
- YouTube, Dailymotion, Vimeo, Twitch, …
- Skinny Bundles
- TV Everywhere

Final Observations

- Improved user experience makes illicit systems more attractive
- Increasing use of IPv6, Encryption, Obfuscation and Distributed Computing make content protection more challenging
- AI and Machine Learning will increase the need for dynamic responses and investments in technology and enforcement
- Cryptocurrencies and smart contracts facilitate monetization

Thank You

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