Online music distribution

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2. Introduction

- This case study examines the implications of Core-Edge dynamics for a vertical industry using the telecomm network as a distribution infrastructure

- Downloading is emerging as a new marketing and fulfillment model in the music industry
  - consumers buy individual tracks (as well as full albums)
  - consumers download music files directly to their hardware for storage, playback, transfer, and (re)distribution

- Preconditions for online distribution include
  - audio compression (MP3, WAV)
  - high bandwidth access
  - end-user resources (PC power & storage capabilities)
  - end-user behaviors (downloading, sharing PC resources and content)

3. Scope and disclaimers

- The research looks at distribution models that support copyright law
- Streaming cases (e.g., Rhapsody) were not included in the research, except for comparative purposes
- The research focuses on the impact of core-edge dynamics on the music value chain
  - the subsequent impact on the broader communications value chain (e.g., an increase in P2P traffic, value migration towards storage, bandwidth, portable music players, etc.), has not been examined in any depth.
- The research doesn't assume that P2P file sharing has a negative, positive, or neutral impact on CD sales

4. A brief history of online music distribution

- Online music distribution was spawned by the user-driven file-sharing movement, as the Internet replaced the sneaker net.

- Following the rise and fall of MP3 Web & FTP sites, P2P networks became the most efficient way to share personal music collections; activity quickly extended beyond fair use.

- P2P networks have appeared in the music industry value chain as a new distribution infrastructure for unauthorized music files.

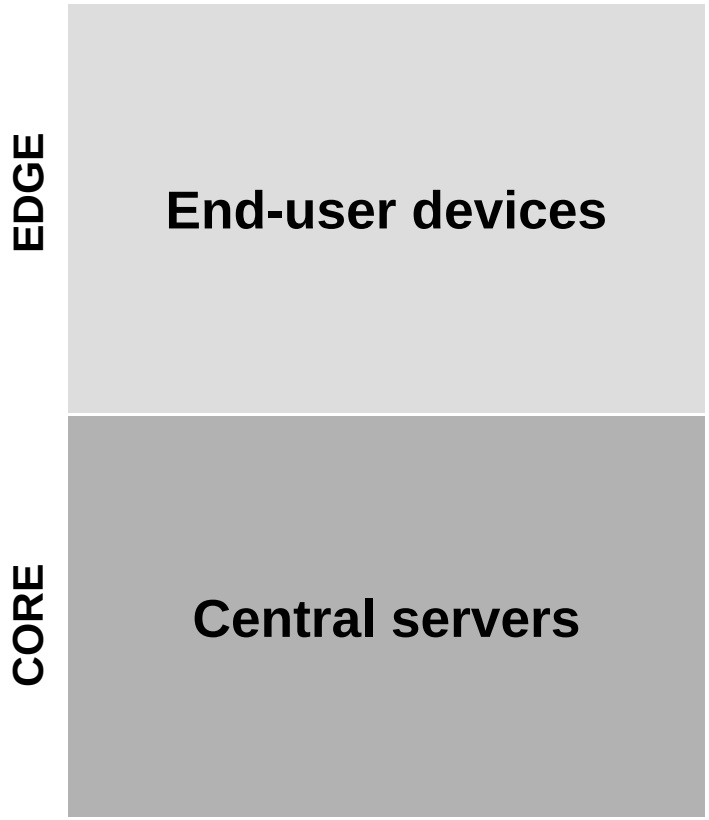
- The music industry has attacked these networks and their users, while contaminating them with garbage files. Nonetheless usage persists and methods to circumvent authority improve (i.e., restrictions drive P2P innovation).

- Nonetheless, client-server models for online distribution of authorized music files have emerged, and most recently, P2P networks are being deployed as efficient distribution and promotion channels for authorized (DRM-protected) music files by independent labels.

5. Core-Edge dynamics

- At the micro level, core-edge dynamics seek to optimize *control* over content (copyright & quality) and *efficiency* of file distribution
  - This is achieved through the strategic implementation of specific service functions at the core or at the edge
- At the macro level, core-edge dynamics reflect the tension between unauthorized and authorized re/distribution
  - Authorized and unauthorized services both seek efficiency but the former seeks to maintain control over copyright while the latter seeks to circumvent this control.

6. Core-Edge dynamics (con't)



Decentralized

Pure P2P networks decentralize all functionality

Semi-centralized

Hybrid models centralize certain functions

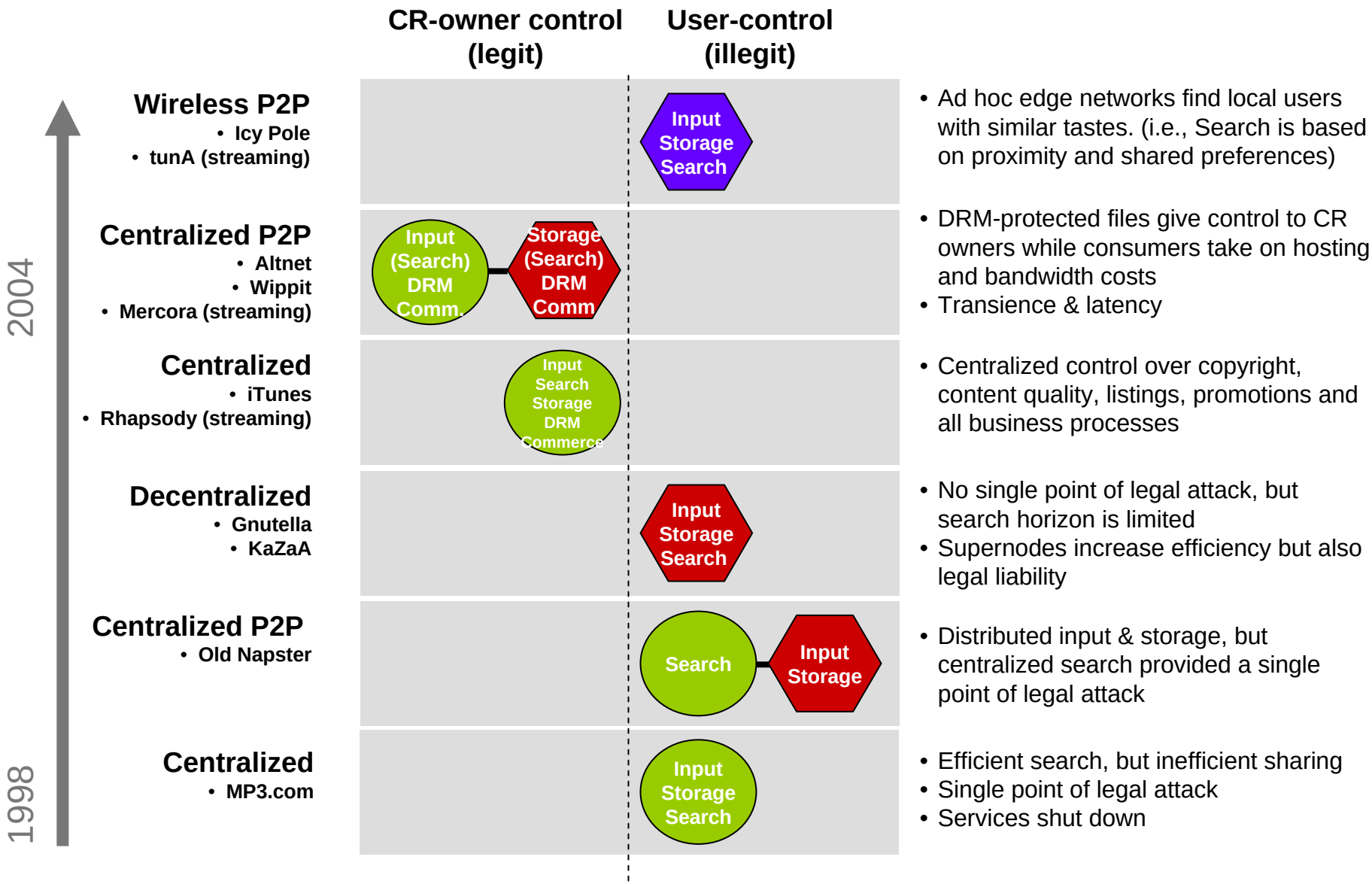
Centralized

Server-download sites centralize all functionality

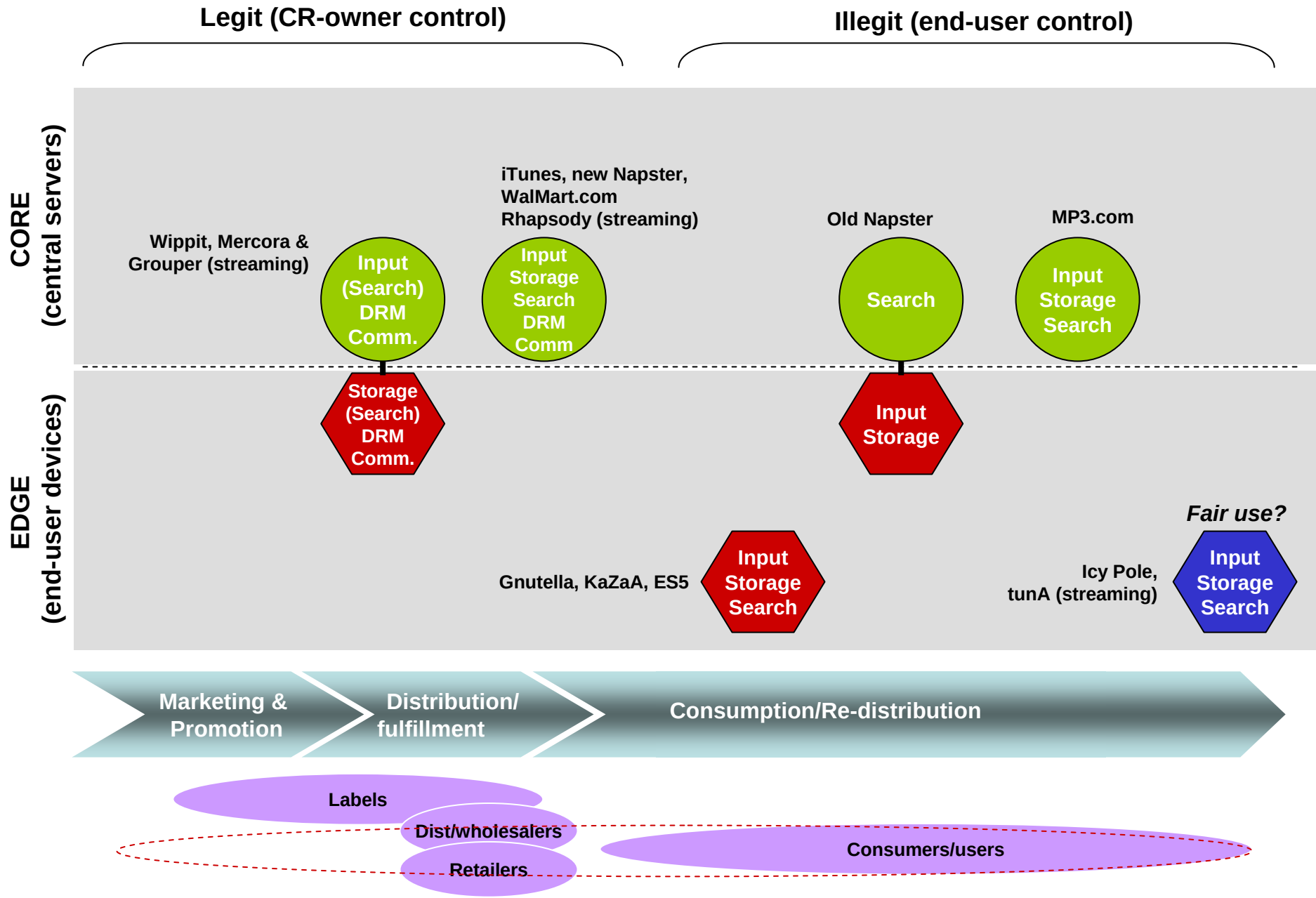
7. Implementation of key functions (micro level)

FUNCTION	CORE	EDGE
Input Source of original file	• Authorized (DRM-protected) copies originate from central server • In P2P apps, users then propagate copies of the DRM-protected file	• Unauthorized copies from users' personal music collections including ripped CDs ("legacy content") and illegal copies newly released digital files
Content storage Inventory	• Content is stored on service provider's central servers	• Content is stored among end-user devices • Multiple copies of a given file can be made available on a P2P network
Search Directories let users see what files are available, and in the case of P2P networks, the associated IP address.	• Centralized directories give a full search horizon • Central servers are a single point of legal attack in P2P networks	• Distributed directories use "trickle down" search with a limited search horizon but no single point of legal attack • Supernodes create client/server efficiency at the edge (but increase risk of legal liability)
Transport Network connectivity	• Most online services use the Internet for transport of files, whether client-server, or P2	• Experiments with mobile devices connected via WiFi and Bluetooth are creating mobile file-exchanges over ad hoc, wireless networks
DRM Digital Rights Management technology	• Licenses are centrally managed	• Most DRM systems interact with components of edge software and devices (e.g., MSN) • DRM is n/a to illegit networks
Commerce services All other supporting services than enable a commercial service	• tracking, billing/payment systems are centrally managed (often integrated with DRM)	• Transaction management piece of DRM systems will likewise interact with parts of edge software and devices (e.g., Weedshare will charge a fee after 3 plays) • Commerce is n/a to illegit networks

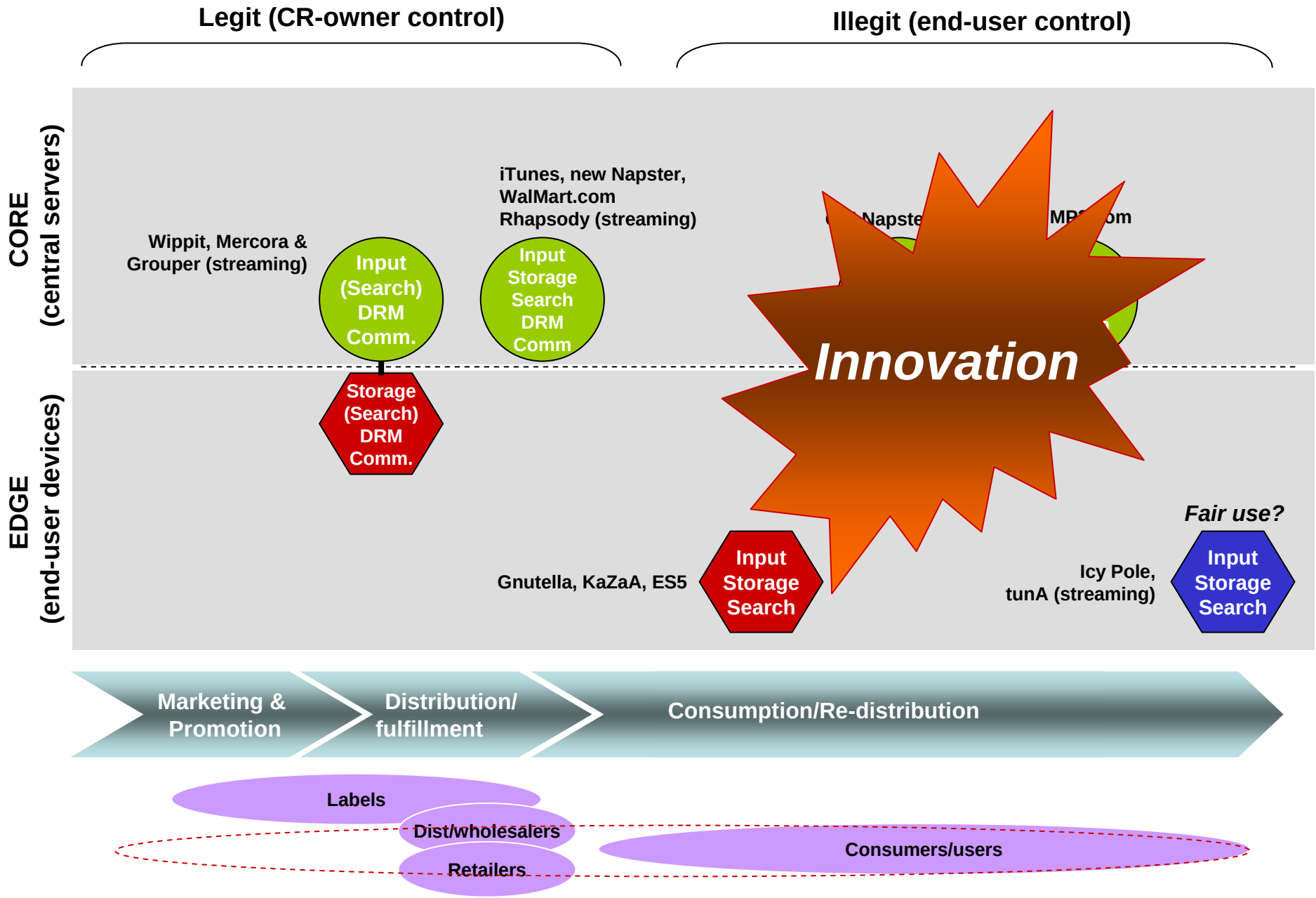
8. The evolution of online music distribution models



9. The value chain perspective (macro level)



10. The value chain perspective (macro level)



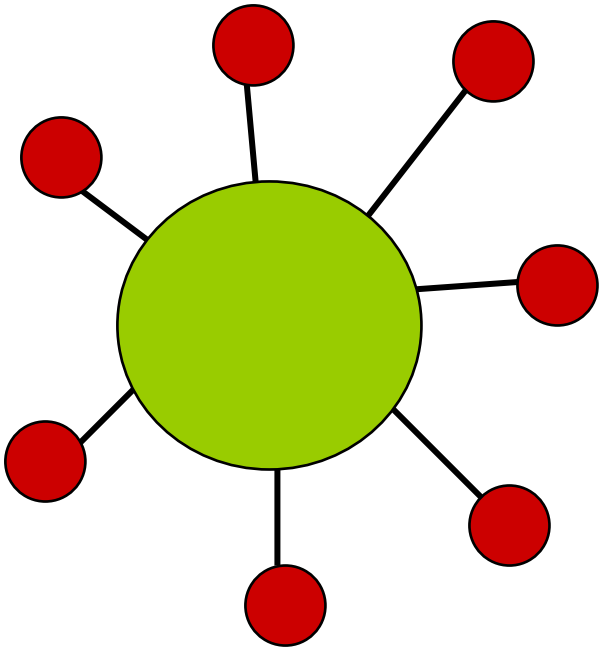
11. Possible areas for further research

- The future of legit P2P networks
  - Will they compete with or complement centralized models as a specialized channel serving distinct market segment(s) based on user demographics (tastes, geek factor) and P2P properties (transience, latency)
  - Will major labels participate?
  - Which P2P models will be adopted (e.g., Wippit vs Altnet)
- The future of illegit P2P networks
  - Increasingly “darker” nets (E.g., ES5)
  - Small world networks that enable “fair use”? (e.g., Grouper, IcyPole)
  - Tragedy of the commons
  - Low quality, high risk relative to legit sites
- Streaming services
  - Centralized (Rhapsody) vs P2P (Mercora, tunA)
  - Will streaming replace downloading
  - Will the “playlist” be what people “own”
  - Will “owning” digital music become a quaint hobby, like owning vinyl?
- The role of DRM
  - Will DRM work?
  - DRM for P2P
- Integration with other P2P apps, e.g., VoIP
- Alternate copyright & business models
- Broader impact on communications value chain
  - P2P traffic and ISP business models
  - Value migration
  - Service provision – core vs edge players

Extra slides
(Online music services)

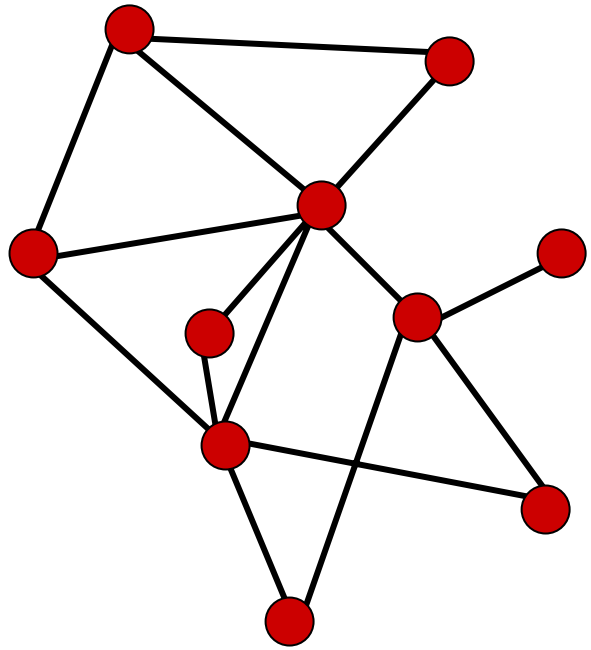
13. Client server vs P2P

Client-server



- All content is stored on central servers
- Edge nodes tap into central resources

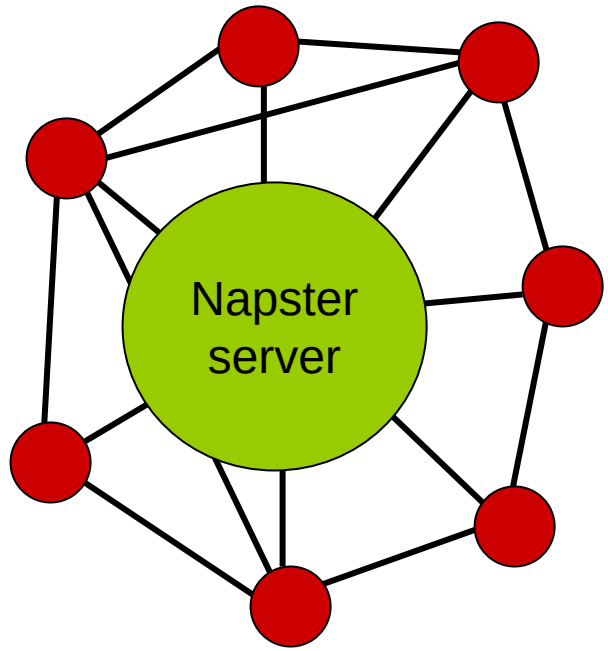
P2P



- Edge nodes (devices) function equally as client + server
- Communication occurs directly between nodes
- P2P networks share resources at the edge: content, storage, CPU power, human presence & availability

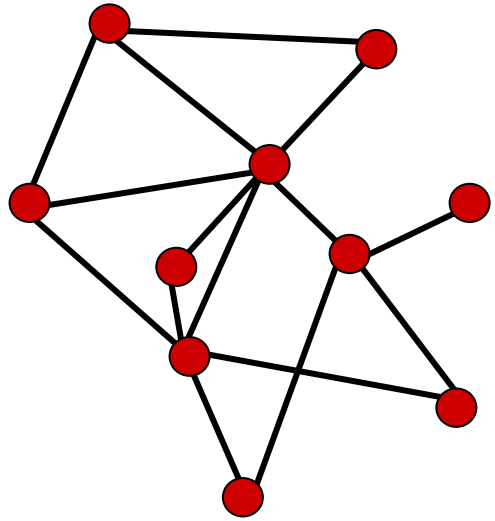
14. Napster – server-centric P2P

- Marked the birth of P2P music file sharing networks in 1999
- Napster is built on a semi-centralized, or “server-centric” architecture
- Napster’s central servers contained a directory of users and their music files
- Users connect to a central server to search for files, then directly to other users’ machines to transfer files between machines
- Napster’s centralized features allowed it to be easily shut down



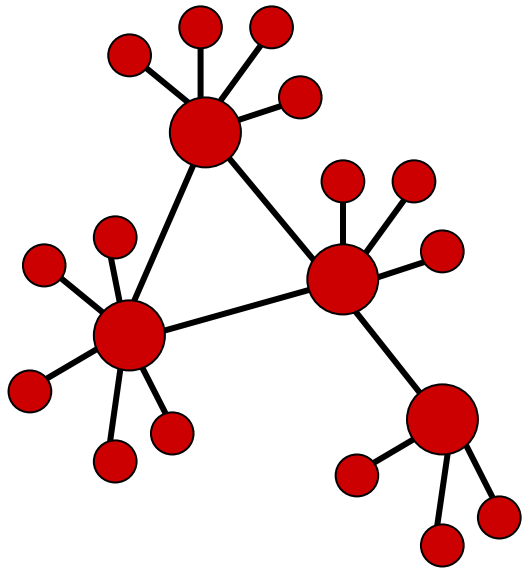
15. Gnutella – extreme P2P

- Gnutella-based networks exchange unauthorized content stored on end-user devices
- No central servers -- search and routing functions are decentralized. Requests pass from one neighboring peer to the next until the file is found.
- Decentralized directories provide a limited search horizon, i.e., an incomplete view of available resources
- However, fully decentralized networks are harder to monitor or shut down because they lack any central point of attack (like Napster)
- No DRM or commerce services (since content is unauthorized)



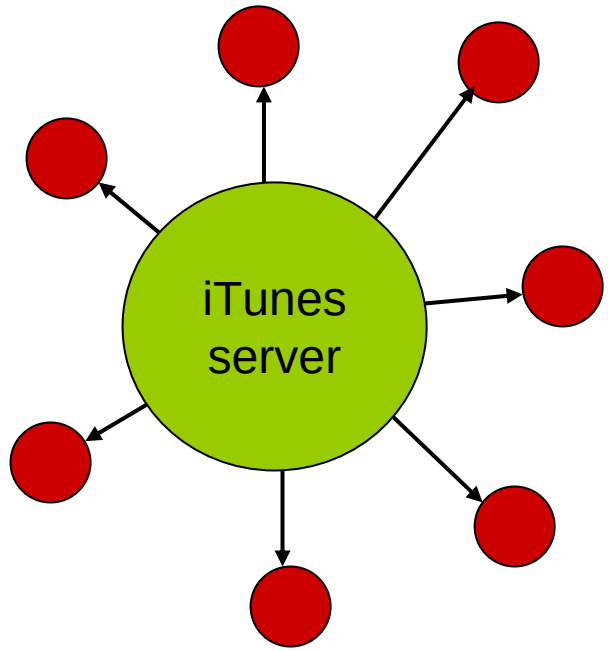
16. KaZaA – peers as servers

- Gnutella-like architecture, but with Supernodes or “super peers” that perform server-type functions
- Peers with high processing capacity, connectivity, and reliability (up time) are automatically designated as supernodes
- Supernodes function as list repositories, primary connection nodes, and search hubs
- There is no single point of *shutdown* (like Napster), however, supernodes are still targets legal attack for the same reason Napster was (i.e., caching collection of pointers to copyrighted materials)



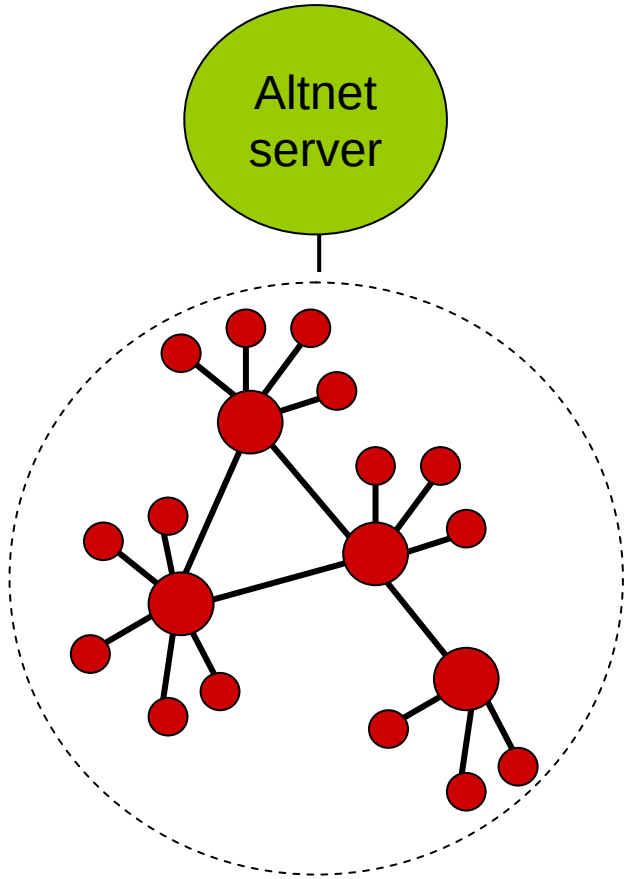
17. iTunes Music Store – centralized control

- First successful legitimate music service for purchasing downloads
- Enables downloading of licensed AAC format files
- Users search a centralized database of licensed music files
- Files are downloaded from iTunes central server
- FairPlay DRM technology encrypts music files to restrict use
- Downloads are “tethered” to Apple’s iPod, i.e., Apple’s centralized strategy also supports a “closed” business model meant to sell iPods
- (It costs $20,000 to fill an iPod from iTunes Music Store)



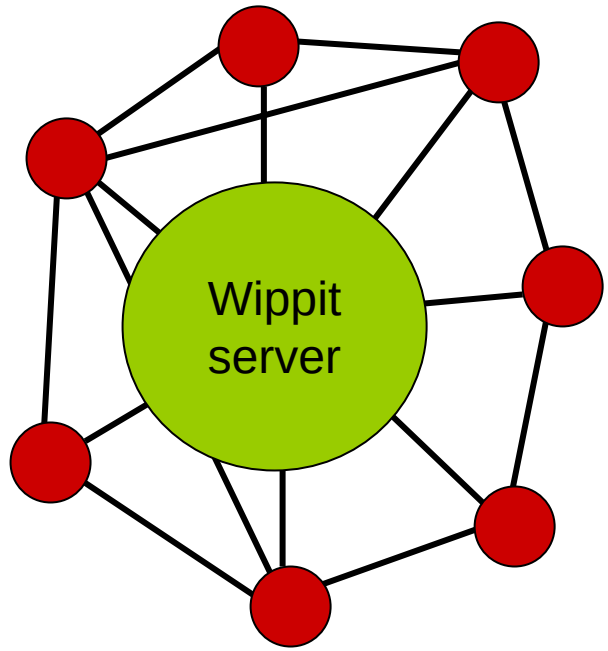
18. Altnet – hybrid P2P for legitimate sales

- Paid download service using the P2P networks for fulfillment
- Altnet technology components are bundled with the KaZaA client application
- Altnet acts as a filter for authorized files. KaZaA search results distinguish Altnet-authorized files from unauthorized files
- DRM technology enables artists to set license terms and royalty fees
- Peer Points system compensates users for storage and bandwidth
- Currently serves local artists and independent labels



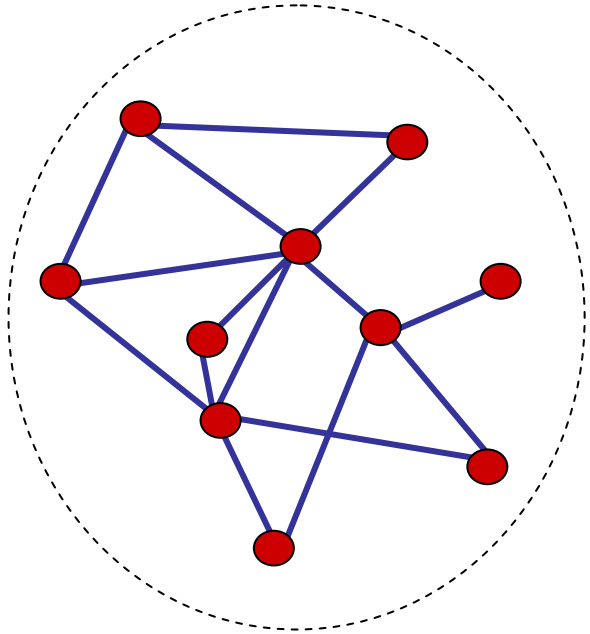
19. Wippit – hybrid P2P for legitimate sales

- Subscription based P2P network
- Users search a centralized database of files available on users' hard drives
- MusicDNA waveform recognition technology matches songs against Wippit's "white list" of licensed MP3s
- The Music DNA analyzer is part of the client software and the white list resides in Wippit's centralized server



20. Icy Pole – ad-hoc P2P content sharing

- Experimental project developed in Australia by agentarts.com
- P2P application for sharing music on Bluetooth enabled mobile phones
- Combines wireless P2P + recommendation engine that alerts users when matching content is within range
- Bluetooth pushes transport to the edge, creating “small world” networks



21. Digital music distribution models

Core edge choices balance control and efficiency

	Input	Content storage	Search	Transport	DRM	Commerce
Napster	Edge	Edge	Core	Core	n/a	n/a
Gnutella	Edge	Edge	Edge	Core	n/a	n/a
Kazaa	Edge	Edge	Edge	Core	n/a	n/a
iTunes	Core	Core	Core	Core	Core + Edge	Core
Altnet	Core	Edge	Edge	Core	Core + Edge	Core
Wippit	Core	Edge	Core	Core	Core + Edge	Core
Icy Pole	Edge	Edge	Edge	Edge	*	*