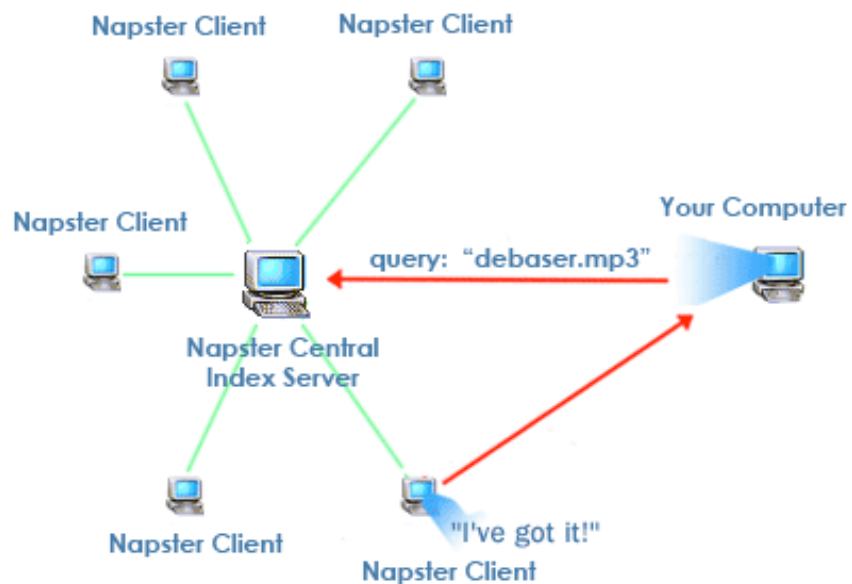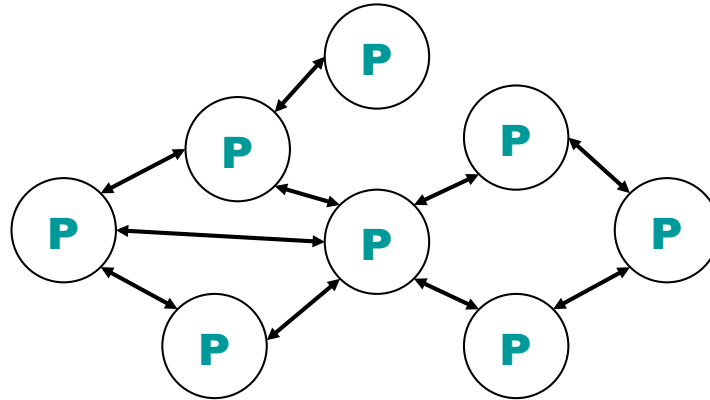# Peer-to-Peer Systems (P2P)

Napster (1999)

Napster Architecture
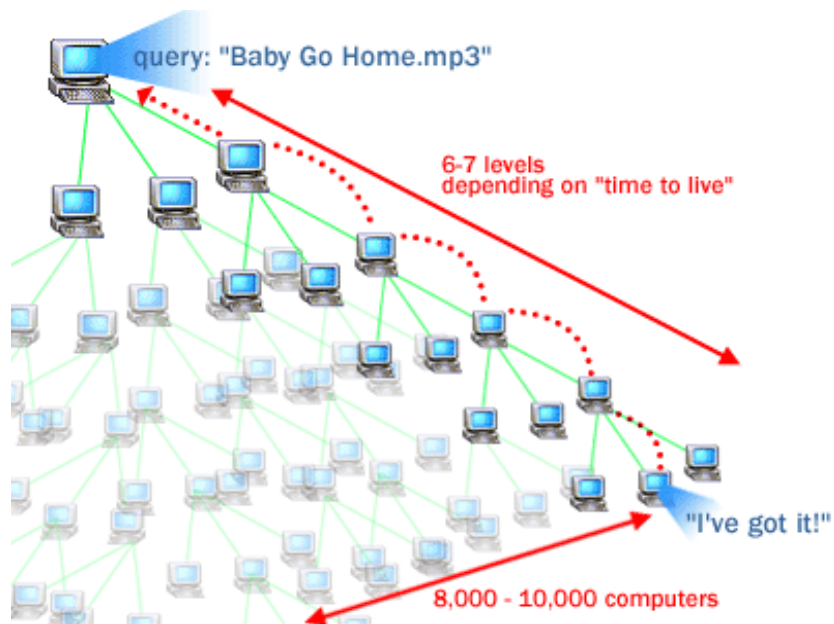
Gnutella (2000)

Gnutella Architecture

Gnutella Queries

query: "Baby Go Home.mp3"

6-7 levels
depending on "time to live"

"I've got it!"

8,000 - 10,000 computers

Kazaa / FastTrack (2000)
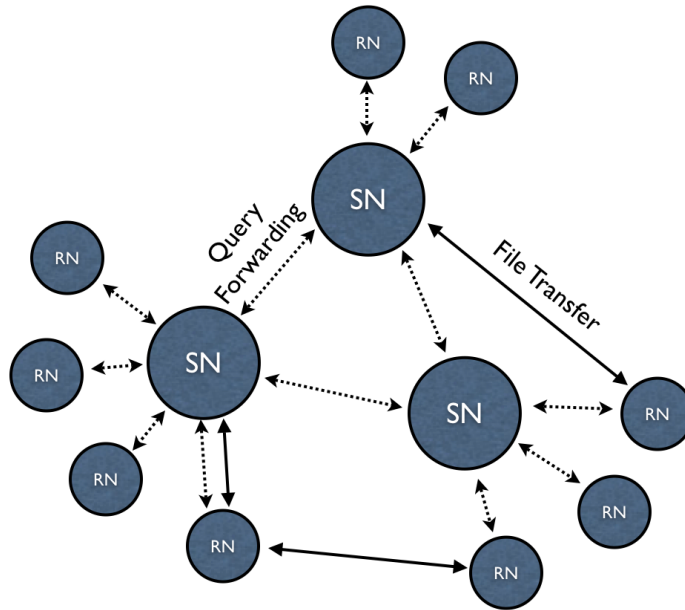
BitTorrent (2001)

BitTorrent Architecture

Sean Barker
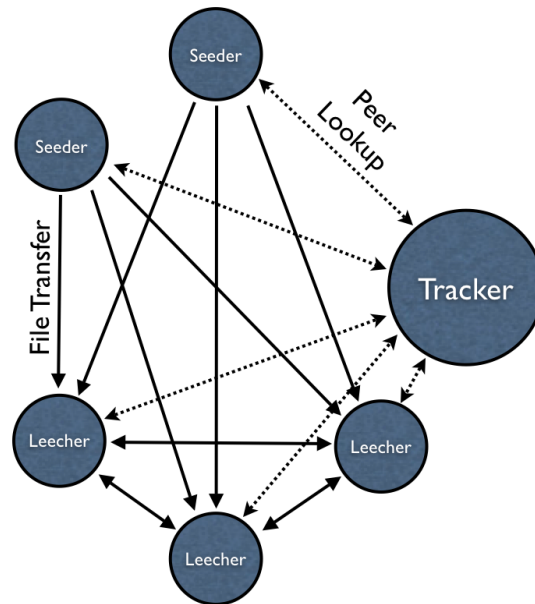
BitTorrent Downloads

Sean Barker
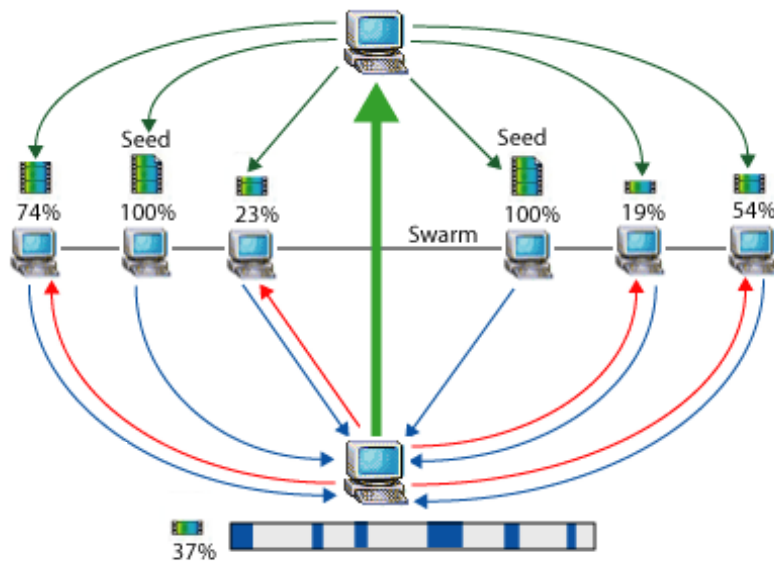
P2P Comparison

	Centralization	Query Model	Scalability	Overhead
Napster	High; central server	Direct server lookup	High	Low
Kazaa	Moderate; SuperNodes	Query flooding	Moderate	Moderate
Gnutella	Low (pre-UltraPeers)	Query flooding	Low	Low
BitTorrent	Moderate; trackers	N/A	High	Moderate
DHT	Low	Direct lookup (exact)	High	High

Spotify (c. 2011)
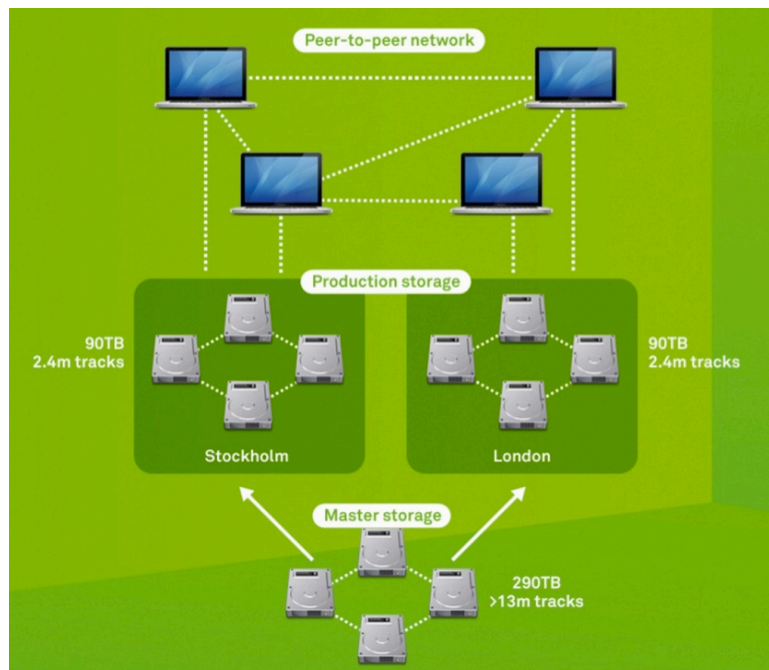
Spotify Request Servicing

Data source - ratio - by week

	Cur:	Min:	Avg:
Server	10.86	6.76	9.62
P2P	33.90	23.78	33.86
Cache	55.24	48.47	56.53