



The Future of the Internet: Peer-to-peer (P2P) overlay-based networking

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The Future of the Internet

Introduction

- Internet: an integral part of our lives
 - Digital communication, work, interaction
 - Technology, information & knowledge sharing
 - Peer-to-peer (P2P)
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Peer-to-peer (P2P) overlay-based networking

Definition

- Decentralised network architecture: mesh-like
 - Direct communication between computers (as both client & server)
 - P2P overlay-based networking protocols
 - BitTorrent
 - TOR
 - Freenet
 - KAD
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Peer-to-peer (P2P) overlay-based networking

Advantages

- Decentralisation: Highly distributed networks
 - Functional without any central servers
 - High fault-tolerance
 - Lower (running) costs
 - Less need for expensive infrastructure
 - High scalability potential
 - Ideal architecture for the future of the Internet
 - Privacy: Anonymous
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BitTorrent

Peer-to-peer (P2P) overlay-based networking

BitTorrent

- Popular file distribution system
 - Divide large files into smaller pieces
 - Each peer downloads & uploads pieces to other peers
 - Sharing information stored in a distributed host system
 - Redistribute load
 - Saves cost
 - Data saved on different host machines - exchange data
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TOR

Peer-to-peer (P2P) overlay-based networking

TOR

- Specialised web browser
 - Onion routing
 - Route traffic through multiple nodes in TOR network
 - Session key generated in each hop gets deleted
 - Difficult to trace traffic source
 - Anonymous
 - More data privacy than standard web browser (i.e. Chrome)
 - Chrome browser: Network goes through ISP servers
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Freenet

Peer-to-peer (P2P) overlay-based networking

Freenet

- Privacy & availability
 - Share & communicate anonymously: publish, replicate, retrieve data
 - Location-independent
 - High availability
 - Scales with number of users
 - Distribute data across network: difficult to censor/block content
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KAD

Peer-to-peer (P2P) overlay-based networking

KAD

- eMule file-sharing app
 - Distributed Hash Table (DHT):
index files & network locations
 - Quick & easy to find consistent format
 - Peers locate & download files from other peers
 - Distributed nature: Grow/shrink system without significant operational impact
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Limitations of Other Technologies & Conclusion

Limitations of Content Centric Networking (CCN) and/or NDN or COAST

Why It May Not Be the Best
Solution for the Future of the
Internet

- Some advantages over traditional IP network
 - Scalability challenges: Significant infrastructure & app changes
 - Limited support for real-time apps
 - Security & privacy concerns
 - P2P Overlay may be better suited for the future of the Internet
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Limitations of MobilityFirst Architecture

Why It May Not Be the Best
Solution for the Future of the
Internet

- High implementation cost
 - Limited compatibility with existing networks
 - Complexity
 - Specialised skills & knowledge
 - Still in research phase
 - Not suitable for all use cases
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Limitations of Adoption of IPv6 and Associated Security Measures

Why It May Not Be the Best
Solution for the Future of the
Internet

- Some advantages: improved address space & security
 - Limits & challenges
 - Compatibility issues with older devices, systems
 - IPv6
 - Costly & time-consuming
 - Requires significant infrastructure upgrades
 - Risk of fragmentation & incompatibility if IPv6 adoption is not universal
 - Combination of different approaches & solutions
 - DNSSEC, HTTP/3, IPsec
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Peer-to-peer (P2P) overlay-based networking

Conclusion

- Promising technology: device and user growth
 - Protect privacy: Anonymous platform
 - Cost saving: spread across users
 - Improved security: data not concentrated in central servers = no single point of failure
 - Difficult for attackers to target and steal data
 - Security concern: No central entity management
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