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Programa de Incentivos à
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Optimizing Video P2P Streaming over Wireless Mesh Networks

Nuno Salta, Ricardo Morla, Manuel Ricardo

Outline

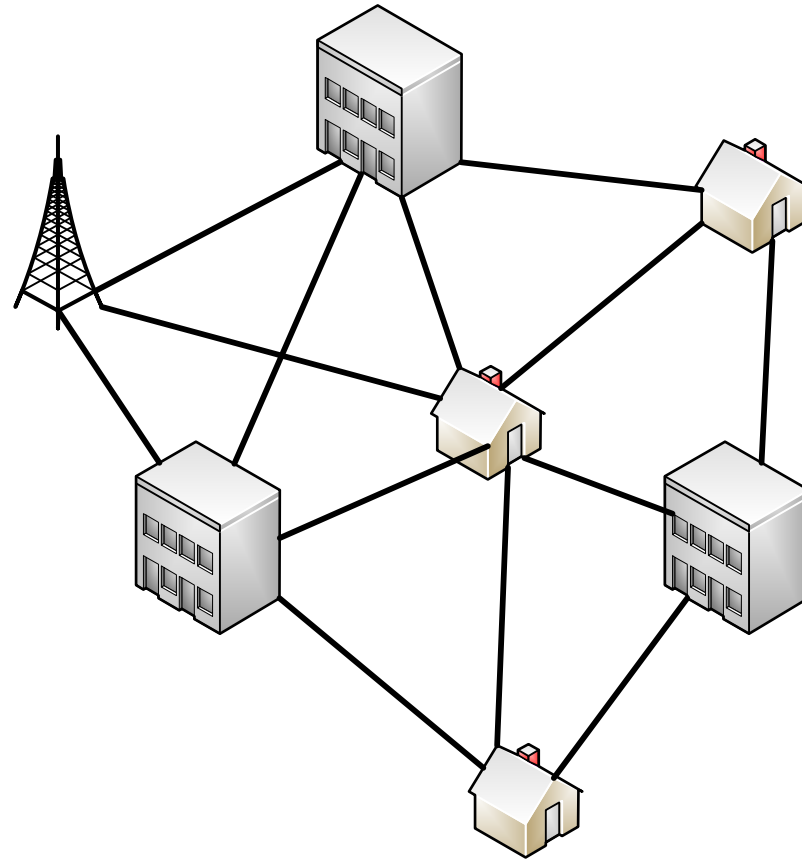
- Introduction
- Work Context
- Problem Statement
- Proposed Solution
- Testbed
- Results
- Future Work
- Conclusion

Introduction

- Internet paradigm is changing in the recent years
- WLANs are
 - Changing the way people access Internet
 - Contributing to the Always Best Connected concept
 - Wireless Mesh Networks (WMN) enables further possibilities
- Peer-to-Peer is playing a decisive role in Internet
 - P2P traffic produced is one of the dominant on the Internet
 - User-side overlay networks created over physical networks
 - Video P2P is an emerging research topic

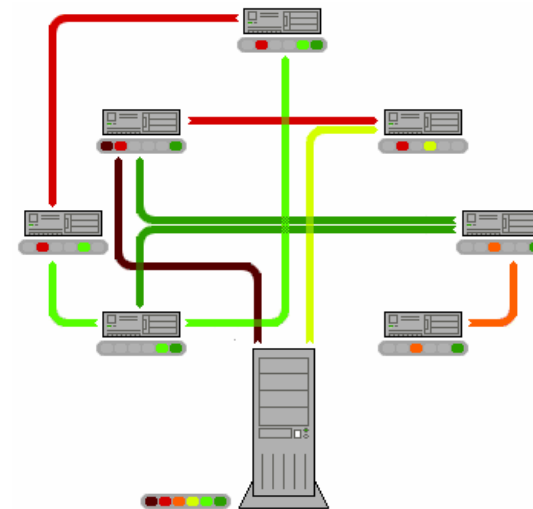
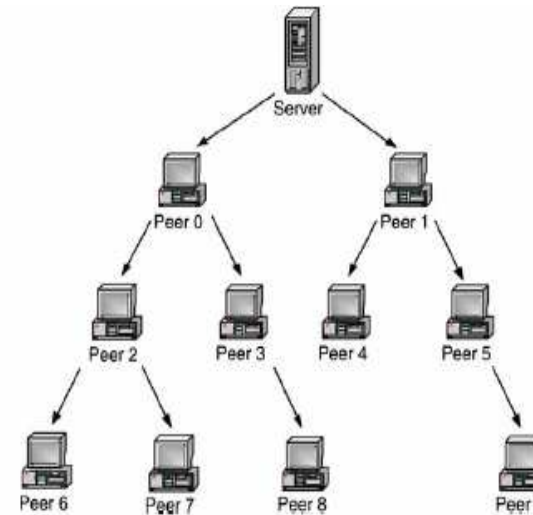
Work Context: WMN

- WMNs are dynamically self-organized and self-configured
- WMNs features
 - Links to multiple neighbours
 - L2 routing
 - Extended coverage
- Can be deployed on
 - Urban centres
 - Shopping areas
 - Public transportation systems
- Some standards
 - 802.11s, 802.15.5, 802.16j



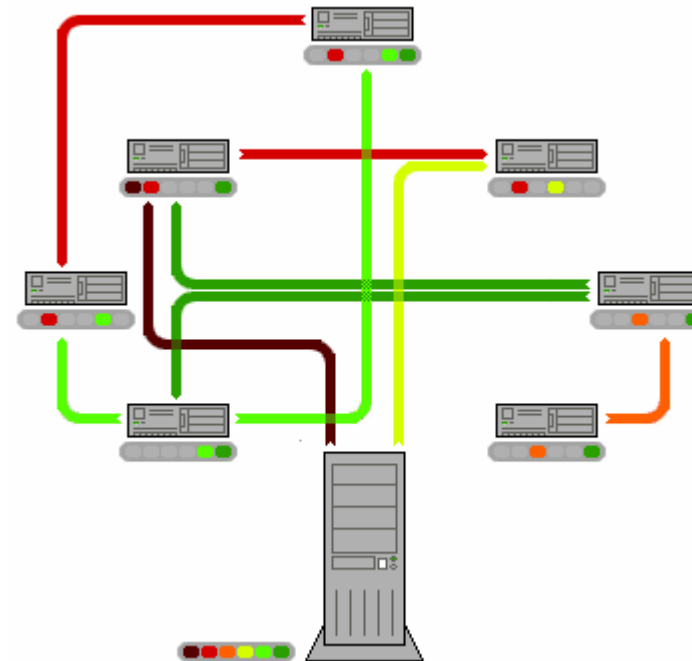
Work Context: Video P2P

- Distribution types
 - Video-on-demand
 - Live feed streaming
- Applications can be classified as
 - Tree based
 - Swarm based
- Important parameters
 - Delay
 - Jitter
 - Chunk priority



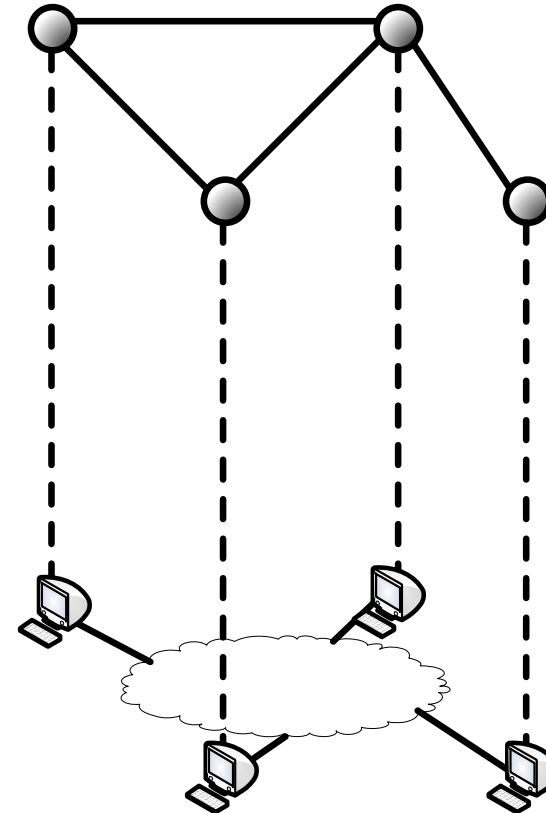
Work Context: Swarm based

- Similar with the traditional P2P file sharing
- Each peer can receive for multiple parents
- A peer can be parent or child in different times
 - Request-reply scheme
 - More flexible
- More resilient to node departures
- Allows better support for mobility



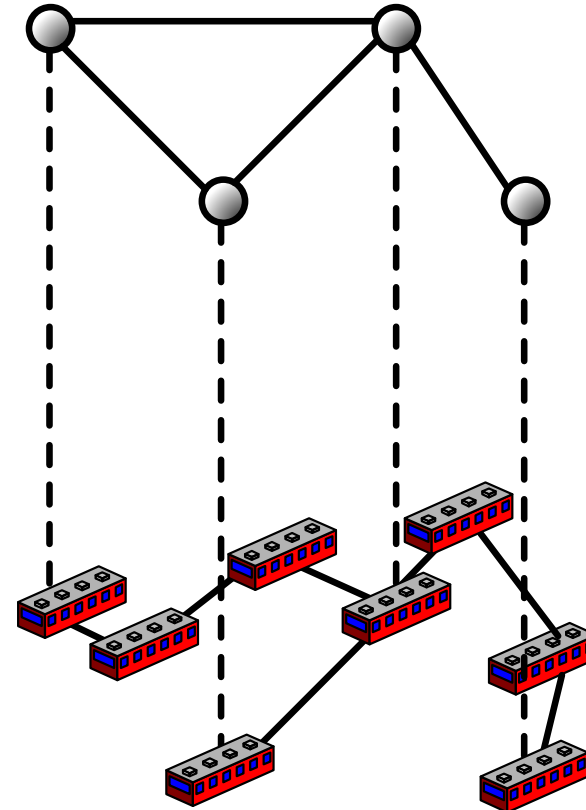
Work Context: Motivation

- **P2P applications**
 - Deployed over physical networks
 - Peers selected from those having the demanded contents
 - Closest path defined at the application layer
 - Application layer paths may be suboptimal
- **In the Internet is difficult to match the physical and the overlay topologies**
 - Multiple domains and types of routing
 - Not all nodes support applications
 - Usually only the edge nodes are in the overlay network



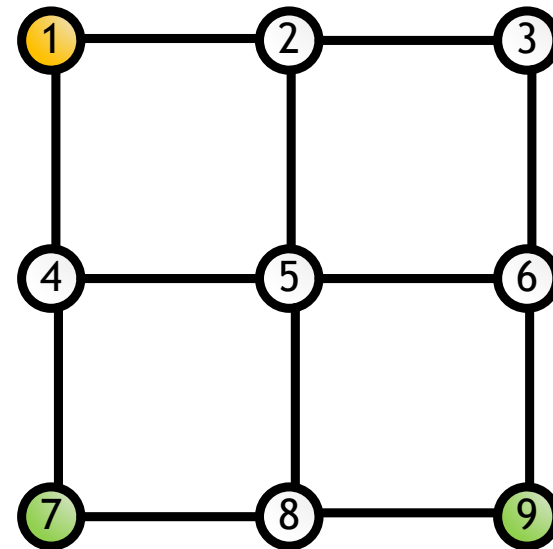
Work Context: Motivation

- In Wireless Mesh Networks, these limitations may not apply
- WMNs have features that may improve P2P performance:
 - Routing behaviour similar to P2P applications
 - Nodes often appear/disappear/move, as in P2P applications
 - Most of the nodes may contain P2P application layer
- WMN topology and overlay topology can mapped in more effective way

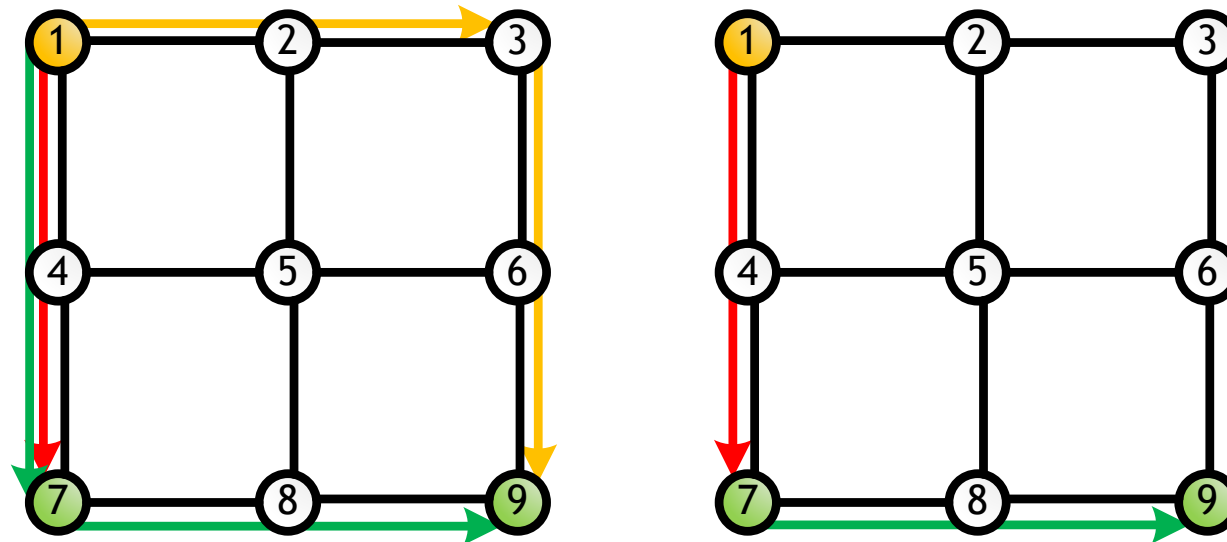


Problem Statement: Reducing duplicated content

- In real-time more than one node may need the same chunk
 - Duplicated content
 - Wasted bandwidth
- Minimize requests for the same chunk
 - Opportunistic capture
 - Multicast-like behaviour but maintains P2P nature
 - Avoid nodes using other streams
 - Define routes (dynamic trees)

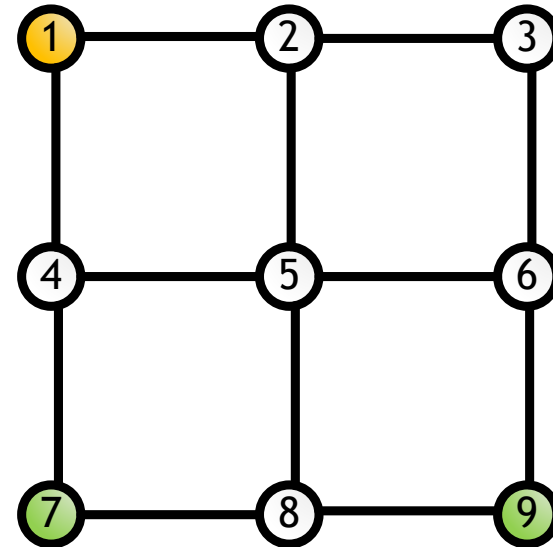


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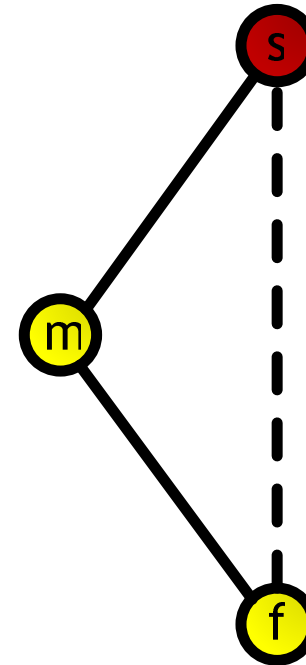
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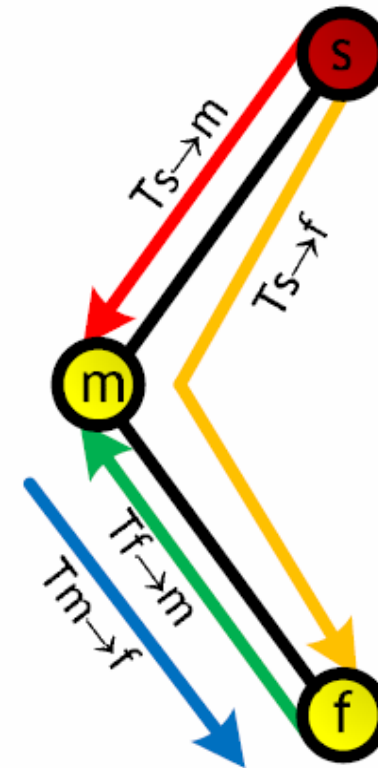
Testbed

- 3 virtual machines
- P2P App: Swarmplayer
 - Swarm-based app
 - Uses modified Bittorrent
- Video stream of 100 kbyte/s
- Traffic captured at middle node
 - Application based on libpcap
 - Stores data for P2P app
 - P2P app modified to use capture data



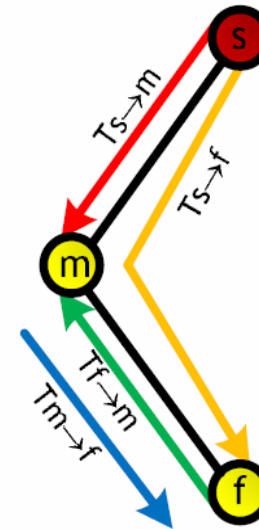
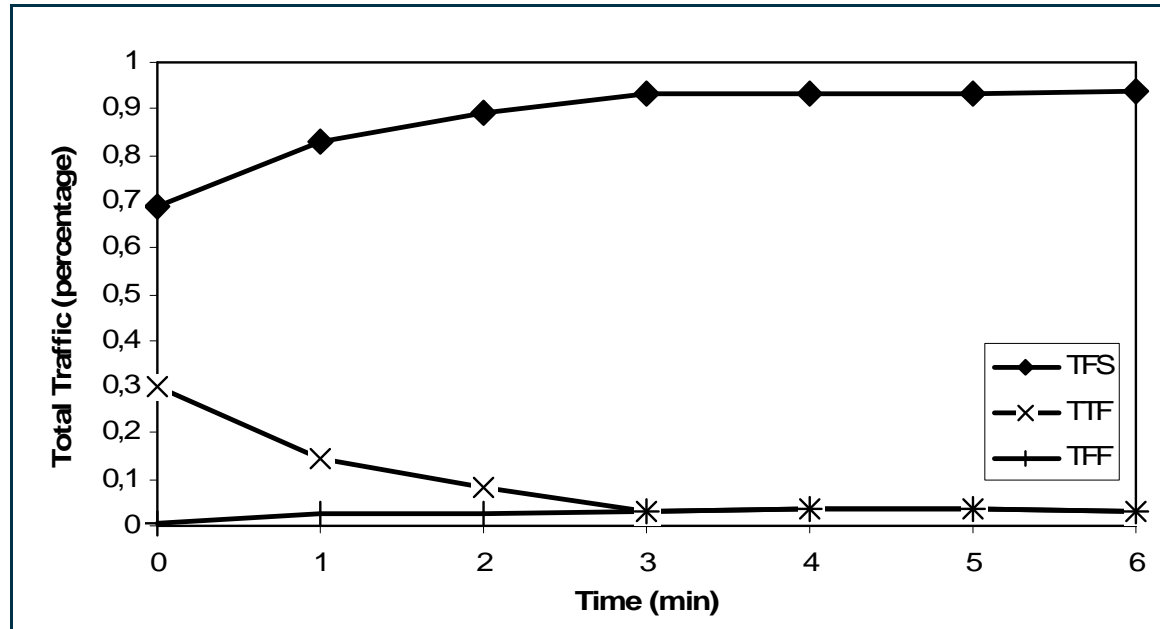
Results

- Objectives
 - Show the reduction of duplicated content
 - Usage of the links
- 4 flows defined
 - Seeder to middle node
 - Seeder to farthest node
 - Middle node to farthest node
 - Farthest node to middle node



$$T_{total} = T_{s \rightarrow m} + T_{s \rightarrow f} + T_{f \rightarrow m} + T_{m \rightarrow f}$$

Results: Duplicated Content – Original Solution



$$TFS = \frac{T_{s \rightarrow m} + T_{s \rightarrow f}}{T_{total}} \quad TTF = \frac{T_{m \rightarrow f}}{T_{total}} \quad TFF = \frac{T_{f \rightarrow m}}{T_{total}} \quad DT = \frac{T_{duplicated}}{T_{total}}$$

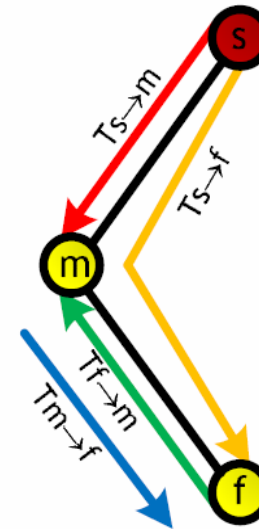
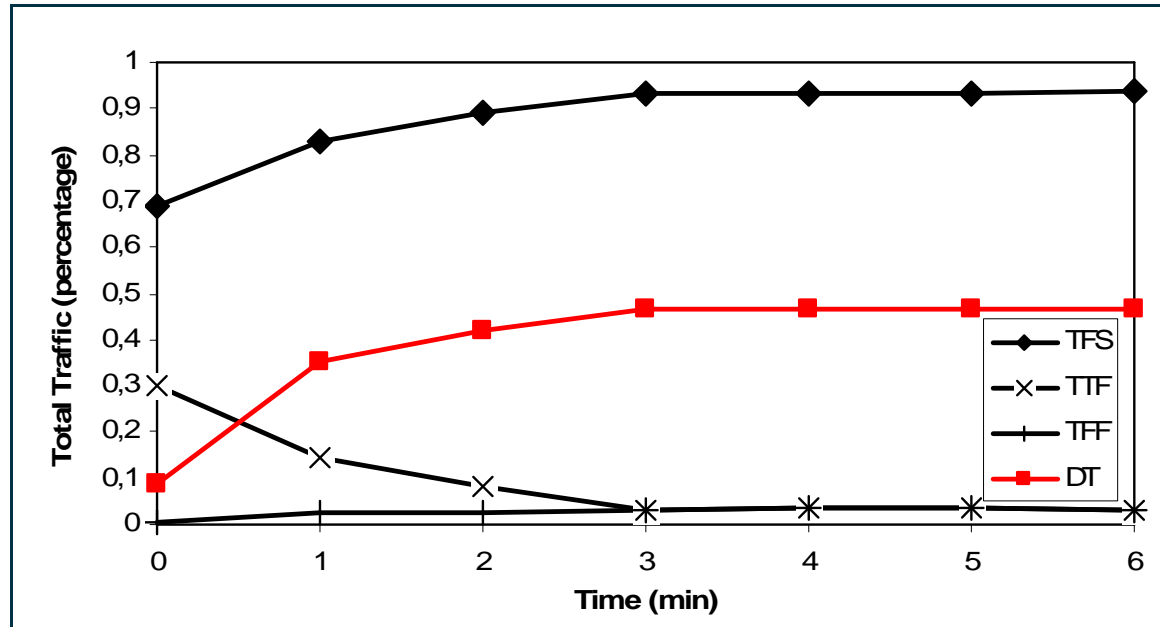
Traffic From Seeder

Traffic To Farthest node

Traffic From Farthest node

Duplicated Traffic

Results: Duplicated Content – Original Solution



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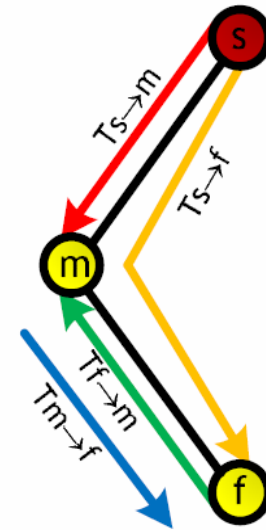
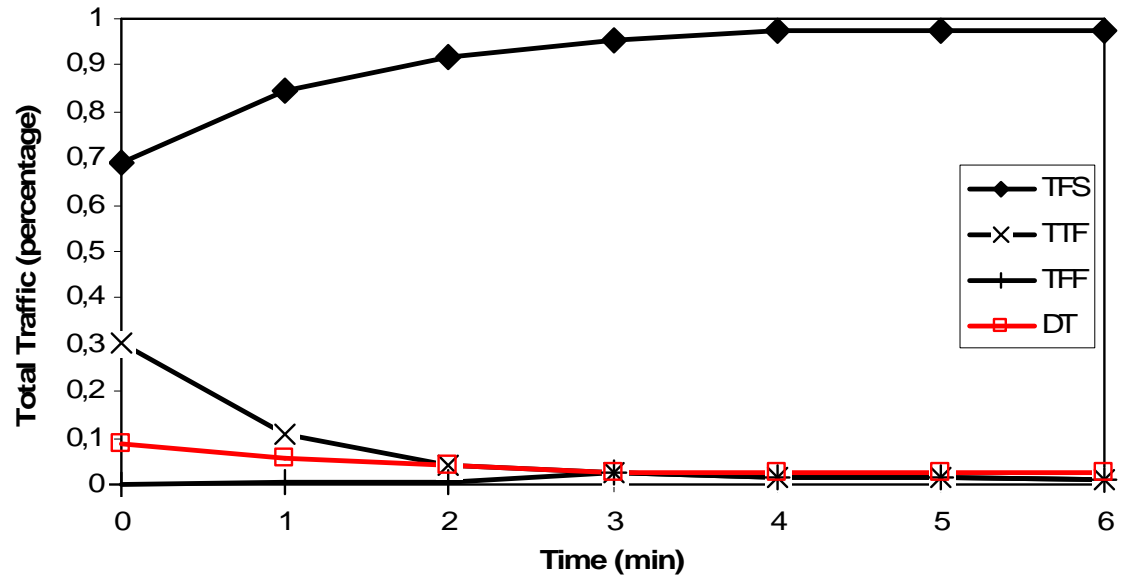
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Traffic To Farthest node

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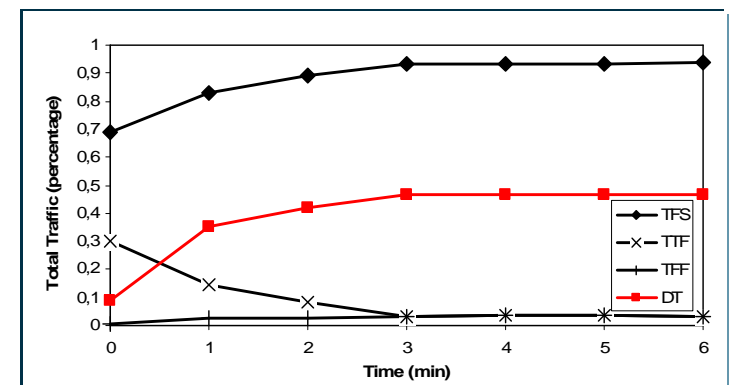
Duplicated Traffic

Results: Duplicated Content – Proposed Solution

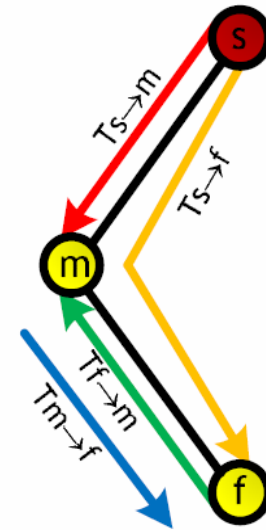
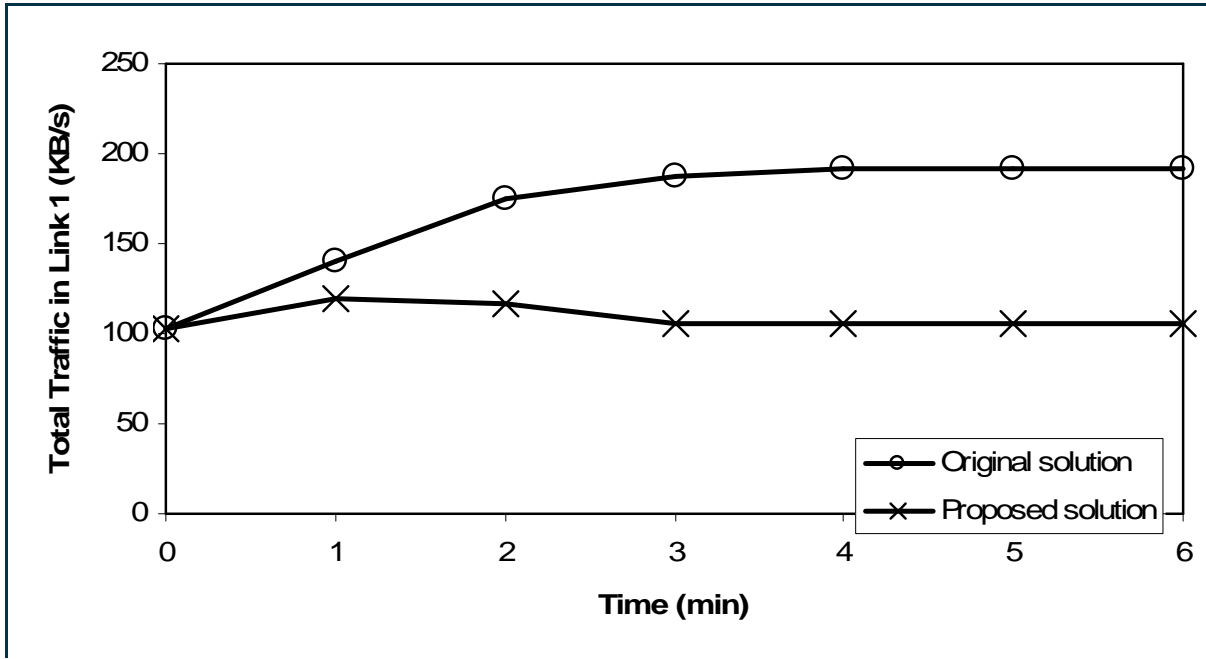


Duplicated content reduced from 47% to 1,32%

Almost no traffic between receivers



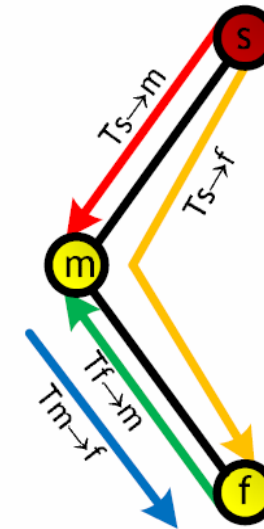
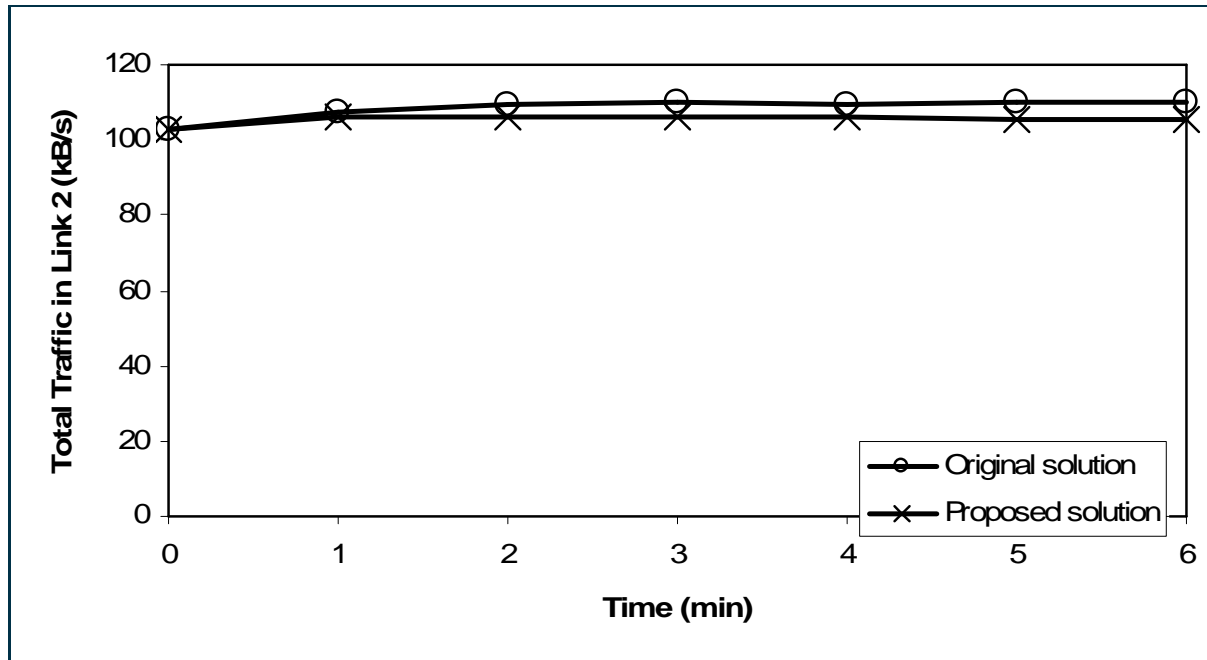
Results: Link 1



Original solution: 192,52 kbyte/s

Proposed solution: 105,72 kbyte/s

Results: Link 2



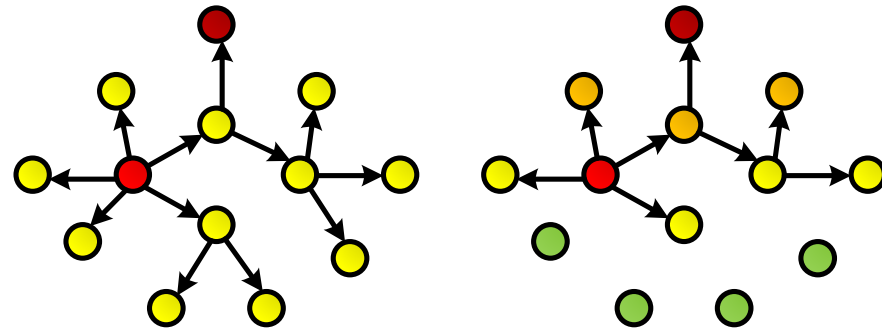
Original solution: 109,73 kbyte/s

Proposed solution: 105,72 kbyte/s

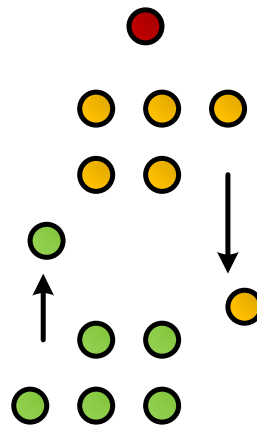
Future Work

- Modify Bittorrent to explicit inform other nodes
- Test with more nodes
- Tweak some parameters

- Explore locality awareness



- Address mobility



Conclusions:

- WMNs and Video P2P are emerging
- WMNs can be explored to improve Video P2P performance
 - Reducing duplicated content by opportunistic capture
 - Multicast-like behaviour whilst maintaining P2P nature
- Modified P2P app to support captured traffic
- Results show
 - Reduction of duplicated content using the proposed solution
 - Reduction of traffic on the links - 300 kbyte/s to 211 kbyte/s