

Path Virtualization over Multiple Heterogeneous Wireless Networks

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> Sangchun Han pit30z@postech.ac.kr



Outline

- 1. Introduction
- 2. Related Works
- 3. Virtual Path
- 4. Conclusion





1. Introduction



Heterogeneous Wireless Networks

- Many wireless networks with different characteristics
 - To support a wide variety of user applications
 - Each has its own characteristics
- More and more wireless networks emerge for better user experience
- It is sure that there is no wireless network which dethrones all other wireless networks
- In the future, various wireless networks should coexist as they are now



Path Diversity

- Mobile device with multiple network interface are emerged
 - This kind of devices may be general in near future
 - Software defined radio
 - e.g. Dual-mode cell phone



Advantages of using Path Diversity

- Parallel transmission
 - Increase total bandwidth
 - Decrease delay
- Path independency
 - Compensate burst errors
 - Increase FEC decoding probability
- Eliminate vertical handoff delay
 - Without the cost of cooperation on the network infrastructures





2. Related Works



Over 802.11 Networks

A Miu, JG Apostolopoulos, W Tan, M Trott, "Low-latency wireless video over 802.11 networks using path diversity", Proc. of IEEE ICME, July 2003





Advantage of Path Diversity

T Nguyen, A Zakhor, "Path diversity with forward error correction (PDF) system for packet switched networks", INFOCOM 2003



Multi source streaming

T Schierl, K Gänger, T Stockhammer, T Wiegand, "SVC-based multi source streaming for robust video transmission in mobile ad-hoc networks", IEEE Wireless Commun. Mag, 2006





Unreliable Paths are Useless

 D. Jurca and P. Frossard, "Media-Specific Rate Allocation in Heterogeneous Wireless Networks", IEEE Packet Video Workshop (PV'06), Hangzhou, China, April 2006., pp.1227-1240, Oct. 2007



Cognitive Radio Networks

Kushwaha, H.; Yiping Xing; Chandramouli, R.; Heffes, H, "Reliable Multimedia Transmission Over Cognitive Radio Networks Using Fountain Codes", Proceedings of the IEEE, vol.96, no.1, pp.155-165, Jan. 2008









3. Virtual Path



Virtual Path





Deployment of Virtual Path Layer



Fountain Code

- LT code, Raptor code, Online code.
- Rateless code
 - infinite encoding symbols (infinite redundancy)
- Erasure code Message Blocks Outer Encoding Composite message with auxiliary blocks Inner Encoding • Check blocks Lossy Channel Check blocks received Inner Decoding Partial composite message Outer Decoding Recovered message CSE MCNL **Г** postech 202

Advantages of Fountain Code

Unreliable paths can be used for better video quality

- Consuming little more bandwidth to eliminate packet loss effect
 - [–] Greedy approach
- Very high packet loss rate can be compensated
- Mobile device can use all possible network resources
- Adaptive coding for time varying characteristics of wireless channels
- If decoding probability is guaranteed, then
 - All packets has the same priority
 - Simple weighted round-robin scheduling is enough to distribute packets among possible paths



Deployment of Fountain Code





Flowchart of Control Unit



Initial Implementation



- Using WLAN and HSDPA
- Real time implementation
- H.263 TMN-2.0 based codec
- QCIF format FOREMAN video sequence



Initial Implementation







4. Conclusion



Conclusion

- Identify the path diversity over heterogeneous wireless network
- Propose the effective path virtualization using fountain code for video streaming
- Implement the initial system
- Support higher bandwidth, lower delay, and lower BLR





Thank you for your attention!

