

A Credit-based Home Access Point (CHAP) to Improve Application Performance on IEEE 802.11 Networks

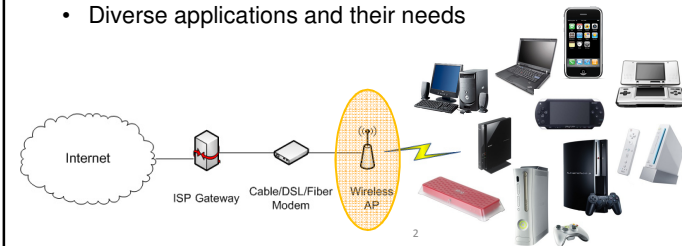
Choong-Soo Lee, Mark Claypool and Robert Kinicki

In *Proceedings of the First ACM Multimedia Systems Conference (MMSys)*, Scottsdale, Arizona, USA, February 2010

In *Proceedings of the ACM Multimedia Conference*, Florence, Italy, October 25-29, 2010

Introduction

- Wide deployment of broadband access at home
- Wireless Access Point to connect devices at home over the shared Internet connection
- Diverse networked devices
- Diverse applications and their needs



Challenge and Possible Approaches

- How to manage **throughput**, **delay** and **loss** with a diversity of applications and their needs
- Possible Approaches:
 - Applications can claim quality requirements.
 - Changes to the end-hosts, applications and protocols
 - Middle boxes can figure out quality requirements.
 - Port/signature-based classification
 - Both approaches require:
 - Pre-determined treatment for traffic classes
 - Careful configuration

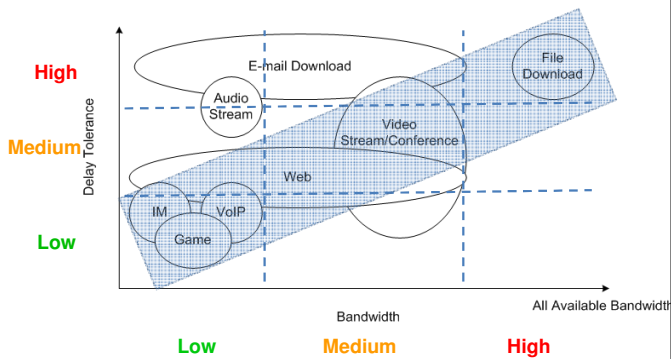
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Outline

- Introduction (done)
- **Credit-based Home Access Point (CHAP)**
- Performance Evaluation
- Conclusion

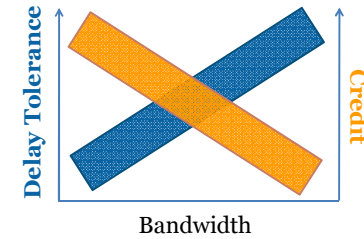
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Summary of Network Traffic Characteristics

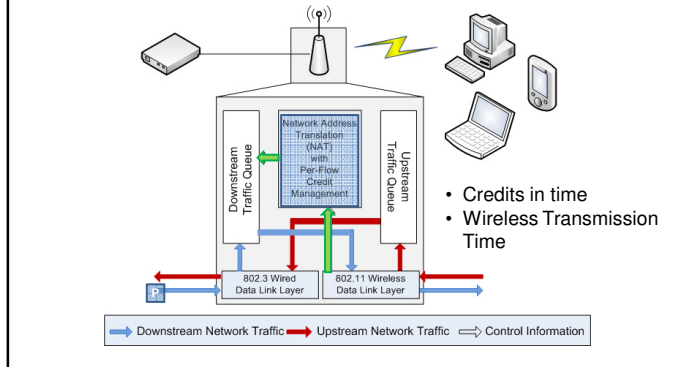


Credit-based Scheduling

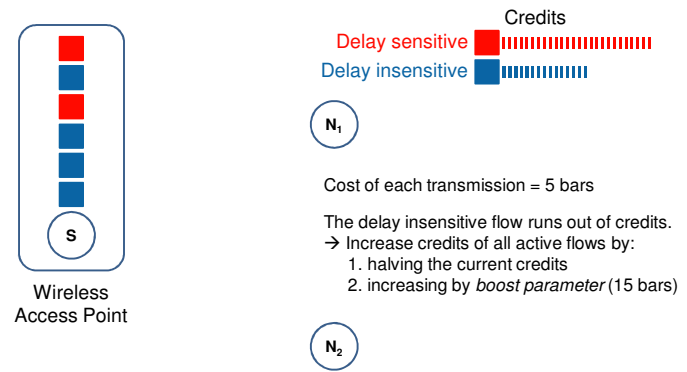
- Use of credit as priority
- Map application traffic characteristics to credit



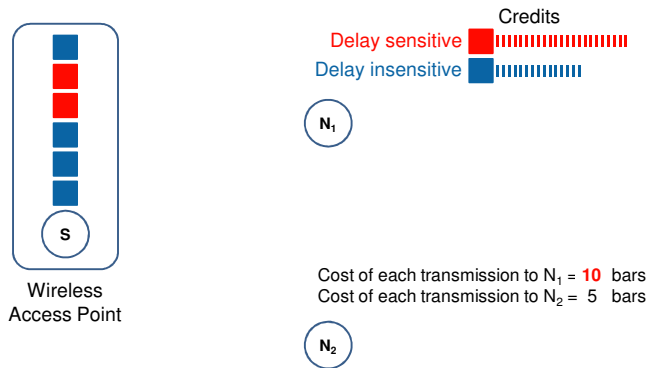
Credit-based Home Access Point (CHAP)



How CHAP Works



How CHAP Works



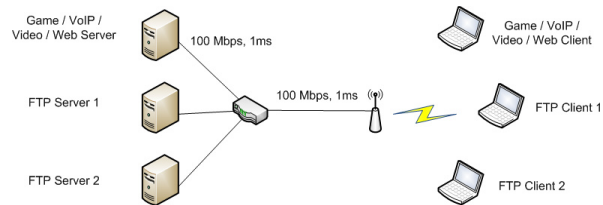
Outline

- Introduction (done)
- Credit-based Home Access Point (CHAP)_(done)
- **Performance Evaluation**
 - Simulation
 - Implementation
- Conclusion and Future Work

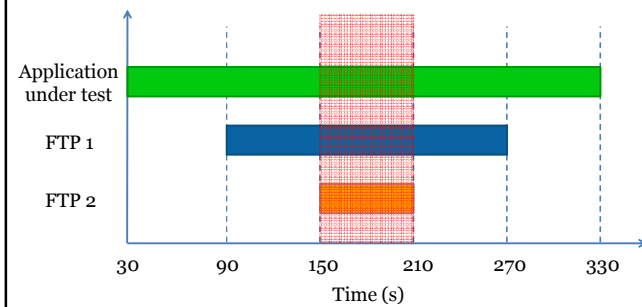
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Simulation Setup

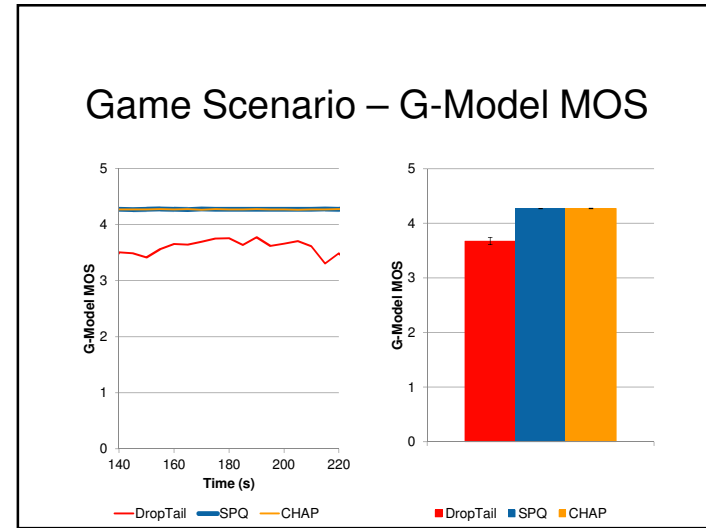
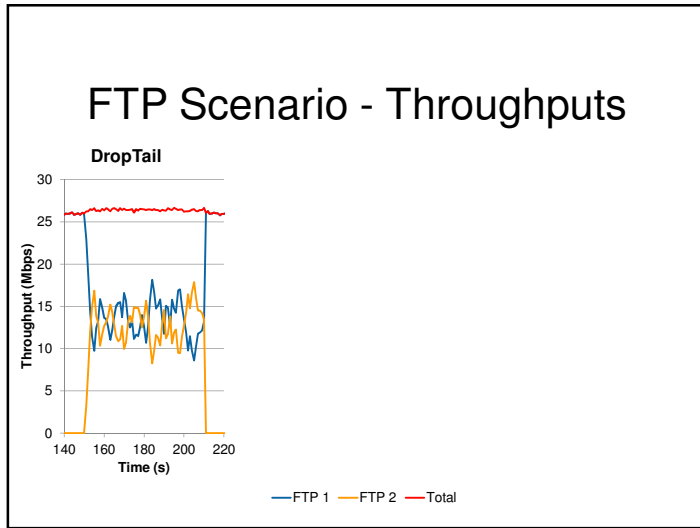
- Network Simulator (NS-2)
 - Single channel, IEEE 802.11g Infrastructure Network
 - Shadowing propagation model
 - DropTail / CHAP / Strict Priority Queue (SPQ)



Simulation Flow Schedule

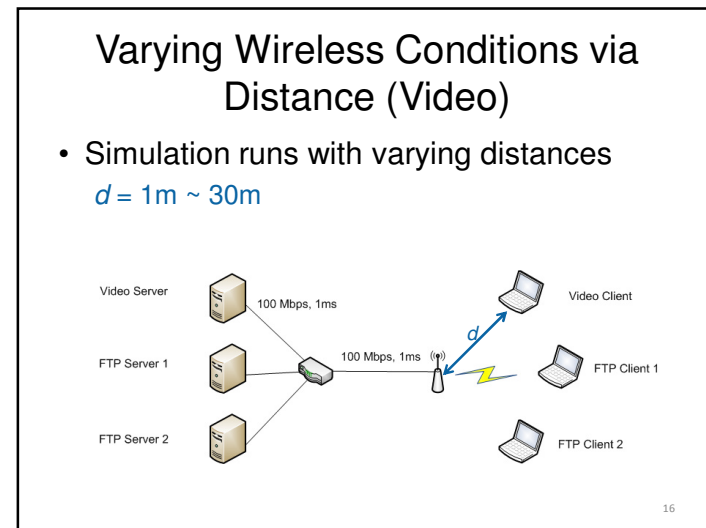


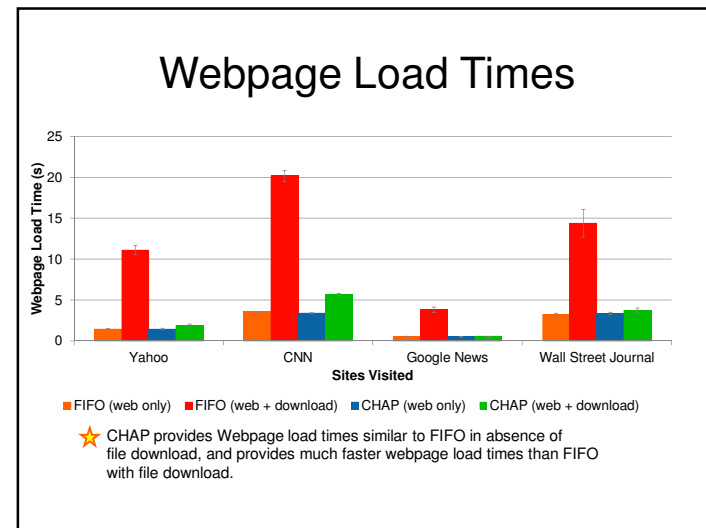
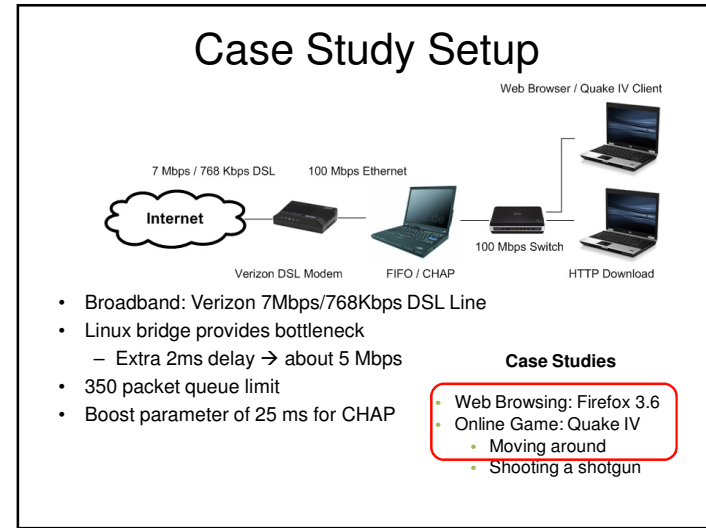
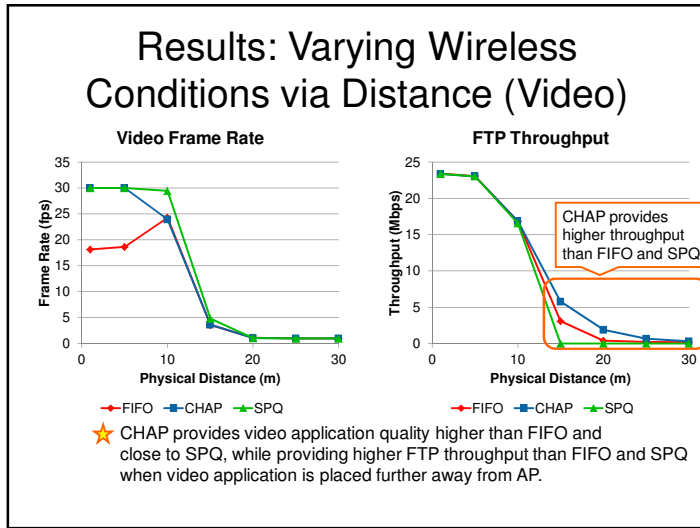
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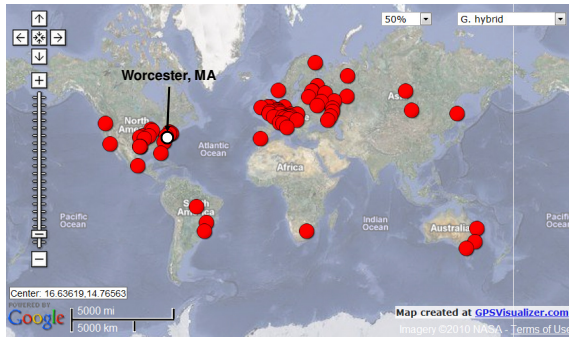
Summary of Performance

Scn.	App (Unit)	DropTail	CHAP	SPQ	% Impr.
Game	Game (MOS)	3.62	3.62	4.27	
	FTPs (Mbps)	21.15	24.91	26.00	
VoIP	VoIP (MOS)	3.89	3.92	4.43	
	FTPs (Mbps)	21.17	26.04	25.17	
Video	Video (fps)	23.12	23.82	30.00	
	FTPs (Mbps)	22.12	22.12	22.95	
Web	Web (ms)	23.22	23.21	23.95	
	FTPs (Mbps)	22.72	25.73	26.54	





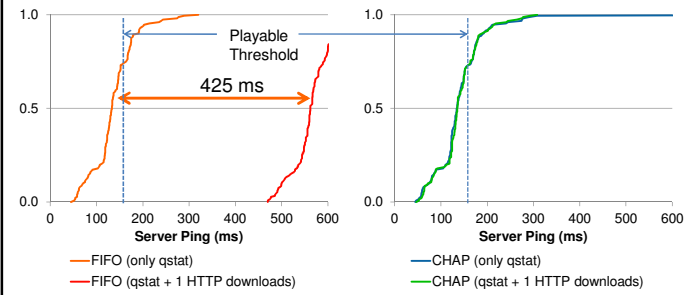
Quake IV Servers



(qstat to get IP address, geolocate IP address on Google map)

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Quake IV Server Ping Times



★ CHAP provides server ping times similar to FIFO in absence of file download, and provides much smaller server ping times than FIFO in presence of file download.

Quake IV – Moving Around

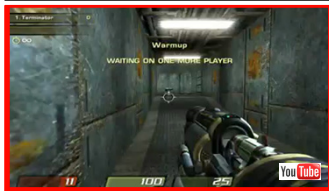


<http://perform.wpi.edu/chap/>

FIFO – Quake IV alone
(62 – 125 ms)

FIFO – Quake IV + Debian ISO Download
(477 – 546 ms)

CHAP – Quake IV + Debian ISO Download
(62 – 94 ms)



★ CHAP allows the player to move around freely as if there is no concurrent file download while FIFO prevents the player from moving due to the large roundtrip time to the server.

Outline

- Introduction (done)
- Credit-based Home Access Point (CHAP) (done)
- Performance Evaluation (done)
- **Conclusion and Future Work**

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Conclusion

- Credit-based Home Access Point (CHAP) improves quality of delay sensitive applications.
 - FTP performance preservation
- CHAP improves performance over DropTail and provides performance close to SPQ.
 - Minimal configuration
 - No explicit classification
 - No pre-determined treatment
- CHAP adjusts to wireless network configuration automatically.
 - Overall performance improvement over DropTail and SPQ

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Future Work?

Future Work

- More evaluation of CHAP
- Formal analysis of CHAP algorithm for setting the increment
- Prototype implementation using a Linux-based access point

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