Do Nintendo handhelds play nice? An analysis of its wireless behavior Adam C. Lusch, Adele V. Fleury and <u>Surendar Chandra</u> University of Notre Dame

Analyzed local play wireless behavior Observed small, frequent packets With slow wireless speed & PCF mode Answer: NO





Question: How nice are Nintendo DS?

Nintendo WiFi service requires access point (AP) permission

AP exerts control over wireless behavior

Local play does not require permission

Coexist in corporate networks, cafes etc.

Goal: Understand interference between Nintendo local play and WiFi







Prior work by Claypool @ Netgames '05

Quotes from Claypool's presentation:

Hand held game packets like PC and console games, but more frequent

- \Rightarrow Payloads less than 100 bytes
- x Inter frame times (non-ACKS) less than 20 msec

Nintendo DS games similar to each other: Sony PSP games vary Nintendo DS games different than Sony PSP games \approx DS games have smaller frames





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Summary of observations from Claypool

- DS uses small packets
 - For other clients: not really
- DS creates lots of small packets
 - Not really many data packets
- DS does not interfere with other wireless users after sync.
 - Catastrophic for TCP. PCF is not TCP friendly





Packets are deceptively small

- DS uses 1 or 2 Mbps mode
- IEEE 802.11 compatibility mode if operating with slow clients
 - 24 @1 Mbps + (n+10) @11 Mbps

- DS packet = (n+10+24)*11
 - 100B pkt = 1474B pkt @ 11 Mbps

Link layer

frame

Data











Increased packet count because of PCF

IEEE 802.11 defines DCF and PCF mode for channel arbitration

- Distributed coordination function (DCF) = CSMA/CA
- Point coordination function (PCF) = contention free

CF-poll CF-ACK CF-ACK CF-ACK

-Contention free –

PCF designed to provide QoS for multimedia + gaming traffic

 \Rightarrow Better variant of PCF: 802.11e

Convention wisdom: PCF is not used

 \Rightarrow Millions of DS disagree!!







Interpacket intervals





Interference of PCF with TCP

DS and TCP traffic on same channel

DS chooses channels randomly 66+06

No DS beacons: invisible

TCP backs-off on collision

PCF is congestion free

☆ will not back off

PCF is not TCP friendly

Need followup study





Conclusions

- Iocal play chooses wireless channels randomly
 - most locations congested anyway (wireless LAN, Bluetooth) (jardosh05)
 - Suggestion: should attempt to choose less congested channel
- PCF + DCF disastrous for TCP
 - PCF not TCP friendly does not back off
 - Suggestion: required further study of PCF + DCF interference
 - ☆ ns2, qualnet do not support PCF mode
- uses slow wireless (used by clients on the fringe)
 - Co-existing with more efficient (faster networks) tenuous
 - Suggestion: should use faster networks



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