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Performance Evaluation of Multihop Wireless Network

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ABSTRACT

In recent years, there has been an upsurge of interest in wireless broadband access networks in both industry and academia. This study aims at evaluating the performance of wireless access networks implemented in the multihop mesh architecture based on IEEE802.11 standards.

An implementation model is defined with the objectives to assess the impact of the variation of several network parameters including the number of mesh access points (MAPs) and stations (STAs), supported profiles, etc. A detailed analysis of the results gathered from 168 simulation runs in OPNET Modeler reveals that the number of MAPs in each extended service set (ESS) could be configured up to 4, the number of STAs associated to each MAP could be up to 8. On the other hand, the EDCA mechanism for QoS support from IEEE802.11e has been considered in the evaluation on both STAs and MAPs. The results show that enabling EDCA mechanism improves the global multihop network performance significantly in the scenarios with more streaming service (more bandwidth demanding) and more real-time applications (more delay stringent and more uplink bandwidth required).

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LIST OF ABBREVIATIONS

AC	Access Category
ACK	Acknowledgment
AIFS	Arbitration Interframe Space
AIFSN	Arbitration Interframe Space Number
AP	Access Point
BSS	Basic Service Set
BSSID	Basic Service Set Identification
CA	Collision Avoidance
CCA	Clear Channel Assessment
CD	Collision Detection
CRC	Cyclic Redundancy Code
CSMA/CA	Carrier Sense Multiple Access with Collision Avoidance
CTS	Clear To Send
CW	Contention Window
DA	Destination Address
DCF	Distributed Coordination Function
DIFS	Distributed (Coordination Function) Interframe Space
DS	Distribution System
DSSS	Direct Sequence Spread Spectrum
EDCA	Enhanced Distributed Channel Access
EDCF	Enhanced Distributed Channel Function
EIFS	Extended Interframe Space
ERP	Extended Rate PHY
ESS	Extended Service Set
FCS	Frame Check Sequence
FHSS	Frequency Hopping Spread Spectrum

FTP	File Transfer Protocol
HCCA	HCF Controlled Channel Access
HCF	Hybrid Coordination Function
HTTP	Hyper Text Transfer Protocol
IBSS	Independent BSS
IFS	Interframe Space
IP	Internet Protocol
ISM	Industrial, Scientific and Medical frequency band
LAN	Local Area Network
LLC	Logical Link Control
MAC	Medium Access Control
MAP	Mesh Access Point
MIMO	Multiple Input Multiple Output
MPDU	MAC Protocol Data Unit
MSDU	MAC Service Data Unit
MWN	Multihop Wireless Network
NAV	Network Allocation Vector
NLOS	Non-line-of-sight
NRTM	Non Real-Time Maximum
NRTC	Non Real-Time Centric
NRT	Non Real-Time
OFDM	Orthogonal Frequency Division Multiplexing
PBCC	Packet Binary Convolutional Coding
PCF	Point Coordination Function
PHY	Physical Layer
PINC	Pairwise Intersession Network Coding
PLC	Power Line Communications
PLCP	Physical Layer Convergence Procedure

PPDU	PLCP Protocol Data Unit
PSDU	PLCP Service Data Unit
QoS	Quality of Service
RT	Real-Time
RTC	Real-Time Centric
RTM	Real-Time Maximum
RA	Receiver Address or Receiving Station Address
RTS	Request to Send
SA	Source Address
SIFS	Short Interframe Space
STA	Station
TA	Transmitter Address or Transmitting Station Address
TCP	Transmission Control Protocol
TXOP	Transmission Opportunity
TGs	802.11s Task Group
UP	User Priority
VoIP	Voice over Internet Protocol
WDS	Wireless Distribution System
WiFi	Wireless Fidelity
WiMAX	Worldwide Interoperability for Microwave Access
WLAN	Wireless Local Area Network
WM	Wireless Medium