## LIST OF SYMBOLS AND ABBREVIATIONS

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Definition</th>
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<tbody>
<tr>
<td>AP</td>
<td>Access Point</td>
</tr>
<tr>
<td>ACK</td>
<td>Acknowledgement</td>
</tr>
<tr>
<td>AQM</td>
<td>Active Queue Management</td>
</tr>
<tr>
<td>$P_e$</td>
<td>Actual probability of dropping the packet</td>
</tr>
<tr>
<td>AODV</td>
<td>Ad Hoc On-Demand Distance Vector</td>
</tr>
<tr>
<td>ATCP</td>
<td>Ad Hoc Transmission Control Protocol</td>
</tr>
<tr>
<td>ATP</td>
<td>Ad Hoc Transport Protocol</td>
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<tr>
<td>ACC</td>
<td>Aggregate Based Congestion Control</td>
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<tr>
<td>ALM</td>
<td>Aggregate Load Metric</td>
</tr>
<tr>
<td>$\lambda$</td>
<td>Arrival rate of a packet</td>
</tr>
<tr>
<td>$\lambda_l$</td>
<td>Arrival rate of legitimate packet</td>
</tr>
<tr>
<td>$\lambda_a$</td>
<td>Arrival rate of malicious packet</td>
</tr>
<tr>
<td>AR$_{ij}$</td>
<td>Assigned rate for the in-out stream (i, j)</td>
</tr>
<tr>
<td>$T_{\text{Assigned rate}}$</td>
<td>Assigned transmission rate</td>
</tr>
<tr>
<td>$L_{\text{loss-attacker}}$</td>
<td>Attack packets loss rate</td>
</tr>
<tr>
<td>ARAN</td>
<td>Authenticated Routing for Ad hoc Networks</td>
</tr>
<tr>
<td>$B_{\text{available}}$</td>
<td>Available bandwidth</td>
</tr>
<tr>
<td>$q_{\text{avg}}$</td>
<td>Average queue size</td>
</tr>
<tr>
<td>REP$_{\text{BQ}}$</td>
<td>Bandwidth query reply</td>
</tr>
<tr>
<td>REQ$_{\text{BQ}}$</td>
<td>Bandwidth query request</td>
</tr>
<tr>
<td>BS</td>
<td>Base Station</td>
</tr>
<tr>
<td>BHAODV</td>
<td>Black hole AODV</td>
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<tr>
<td>BnBW</td>
<td>Bottleneck Bandwidth</td>
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<tr>
<td>CSMA/CA</td>
<td>Carrier Sense Multiple Access/ Collision Avoidance</td>
</tr>
</tbody>
</table>
CA - Certificate Authority
COT - Channel Occupancy Time
CTS - Clear to Send
CGSR - Clusterhead Gateway Switch Routing
CB - Congestion Bit
CE - Congestion Experienced
$W_i$ - Congestion window size of round i
CBR - Constant Bit Rate
CW - Contention Window
DIFS - DCF Inter Frame Space
DoS - Denial of Service
DSDV - Destination Sequenced Distance Vector
DIFF_TIME - Difference between the $RREQ_{OUT\_TIME}$ and $RREP_{IN\_TIME}$
DH - Diffie Hellman
DCF - Distributed coordination function
DDoS - Distributed Denial of Service
DSR - Dynamic Source Routing
ESP - Encapsulating Security Protocol
ECN - Explicit Congestion Notification
FAP - Flooding Attack Prevention
FMON - Flow Monitoring
FMT - Flow Monitoring Table
HMAC - Hashed Message Authentication Code
$q_i$ - Increase in queue size due to attack traffic
$q_{inst}$ - Instantaneous queue size
ICMP - Internet Control Message Protocol
IP - Internet Protocol
IDS - Intrusion Detection System
Kbps - Kilo bits per sec.

$S(t)$ - Legitimate packet’s service time

LBDS - Load Balancing based Detection System

LM - Load Metric

LP - Load Packet

LT - Lower Threshold

$P_m$ - Marking probability

$max_{th}$ - Maximum threshold value of queue size

$P_{max}$ - Maximum value of marking probability

ta - Mean attacker’s service time

tl - Mean legitimate service time

$\mu$ - Mean service rate

$\bar{t}$ - Mean service time

tli - Mean service time for legitimate packets

$MR_{ij}$ - Measured rate from the in-out stream (i, j)

MAC - Medium Access Control

$min_{th}$ - Minimum threshold value of queue size

MIN_TIME - Minimum time

MANET - Mobile Ad Hoc Network

MAODV - Modified Ad hoc On-Demand Distance Vector

MRED - Modified Random Early Detection

NRMT - Neighborhood Route Monitoring Table

NS - Network Simulator

$L$ - No. of links

$L_{loss-normal}$ - Normal packet loss rate

OLSR - Optimized Link State Routing

$L_{loss}$ - Overall packet loss rate in the network due to N nodes
PDR - Packet delivery ratio
\( L_{\text{loss}}(x) \) - Packet loss rate due to congestion
\( \beta \) - Packet sending rate of each flow
PDA - Personal Digital Assistant
PCT - Private Communications Transport
\( P_{\text{loss}}(x) \) - Probability of packet lost due to congestion
\( P_k(x) \) - Probability that node x has k packets in its queue
PRF - Pseudo Random Function
PKI - Public Key Infrastructure
QoS - Quality of Service
RX - Received Packets
RoQ - Reduction of Quality
RTS - Request to Send
RR - Reserved Rate
RTO - Retransmission Time Out
RTT - Round Trip Time
RERR - Route Error
RREP - Route Reply
RREQ - Route Request
\( R_{ls} \) - Routing matrix with source s and link l
SEAD - Secure Efficient Ad hoc Distance vector
SRSN - Secure Routing based on Sequence Number
SSL - Secure Socket Layer
\( \mu \) - Service rate of a packet
\( \mu_l \) - Service rate of legitimate packet
\( \mu_a \) - Service rate of malicious packet
SIFS - Short Inter Frame Space
s - Smoothing gain
SE<sub>th</sub> - Stopping time of congestion window count
TCP-ELFN - TCP Explicit Failure Notification
TCP-F - TCP Feedback
TORA - Temporally Ordered Routing Algorithm
C<sub>ij</sub> - The counter for the number of bits received in the current measurement window
RE<sub>th</sub> - Threshold value of number of retransmissions
RC<sub>th</sub> - Threshold value of RTS/CTS packets
RREP_IN_TIME - Time at which RREP packet enters the node
RREP_OUT_TIME - Time at which RREP packet leaves the node
RREQ_IN_TIME - Time at which RREQ packet enters the node
RREQ_OUT_TIME - Time at which RREQ packet leaves the node
t<sub>out</sub> - Time out value
T<sub>ACK</sub> - Time required to send ACK frame
T<sub>CTS</sub> - Time required to send CTS frame
T<sub>RTS</sub> - Time required to send RTS frame
TTL - Time To Live
B<sub>t</sub> - Total bandwidth
B<sub>i,consumed</sub> - Total consumed bandwidth by the neighborhood nodes of i<sup>th</sup> node.
T(x) - Traffic experienced by a node x
TCP - Transmission Control Protocol
x<sub>a</sub>(t) - Transmission rate at time t
T<sub>d</sub> - Transmission time of a data packet
TX - Transmitted Packets
TLS - Transport Layer Security
UT - Upper Threshold
UDP - User Datagram Protocol
ρ<sub>a</sub> - Utilization factor of attacker
<table>
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<tr>
<th>Symbol</th>
<th>Description</th>
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<tbody>
<tr>
<td>( \rho_l )</td>
<td>Utilization factor of legitimate user</td>
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<tr>
<td>WEP</td>
<td>Wired Equivalent Privacy</td>
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<tr>
<td>WLAN</td>
<td>Wireless Local Area Network</td>
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<tr>
<td>WMAN</td>
<td>Wireless Metropolitan Area Network</td>
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