Packet Packing and *m*TBEB Simulation Results

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Overview

- **Packet Packing Overview[1]**
- **Simulation Results**
- ***m*TBEB (Scaled Backoff[1]) Simulation Results**
- **Observations**

1. Reference *Carrier Extension Issues*, by Stephen Haddock presented 5/21/96

Overview

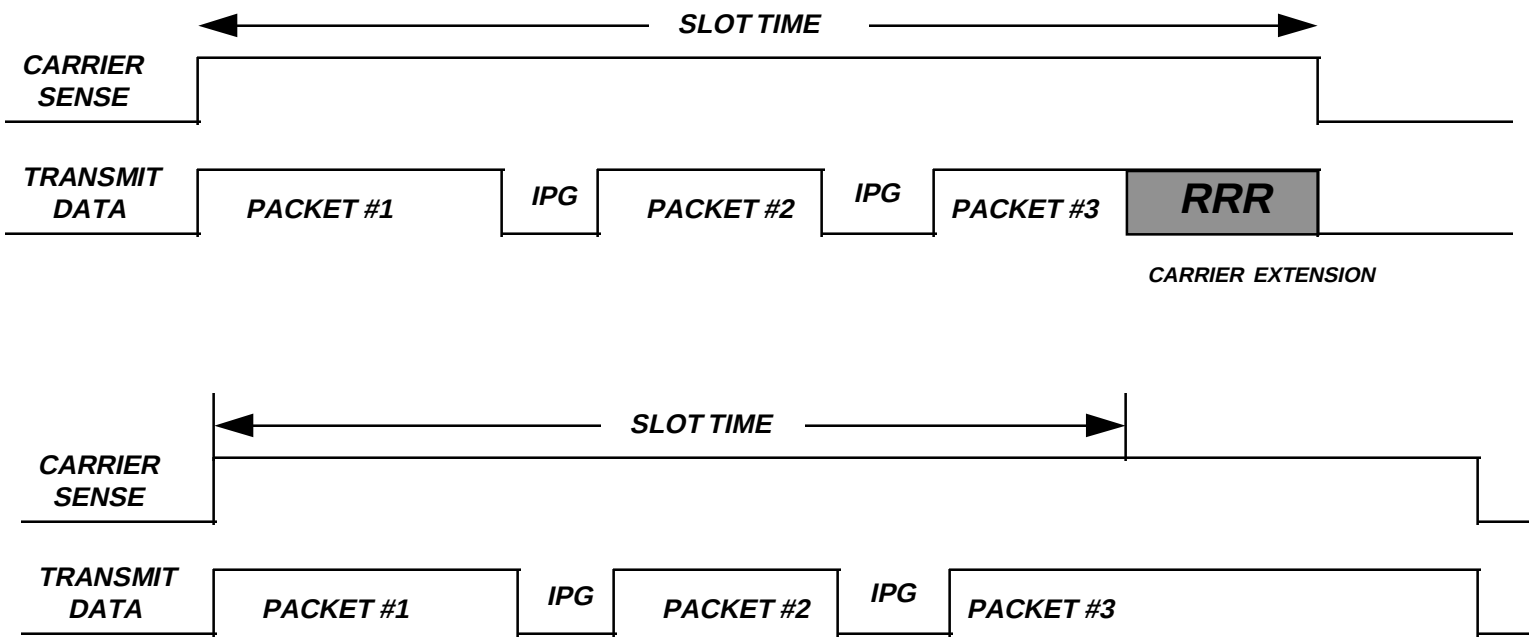
- **Carrier Extension "*wastes*" up to 448 bytes for small packets**
- **Propose sending multiple packets in slot time if possible**
- **Current encoding proposal allows carrier extension (R character) indications**
- **All packets sent in a slot time are retransmitted by transmitter (and dropped by a receiver) if collision occurs**

⇨ **Allows implementation of carrier extension & packet packing within current framework**

Overview

- **Station transmits first packet**
- **Station transmits subsequent packets inserting IPG spacing until last packet transmission exceeds slot time**
- **If there are no packets in the transmit queue and slot time is not complete, extend carrier as before**

Packet Packing Timing



Simulation Environment

- 1000 Mbps Network
- 15 stations
- 512 byte slot times
- 200m network diameter
- Packet size distributions
  - All 64 bytes
  - All 1518 bytes
  - Workgroup average

Simulation Results

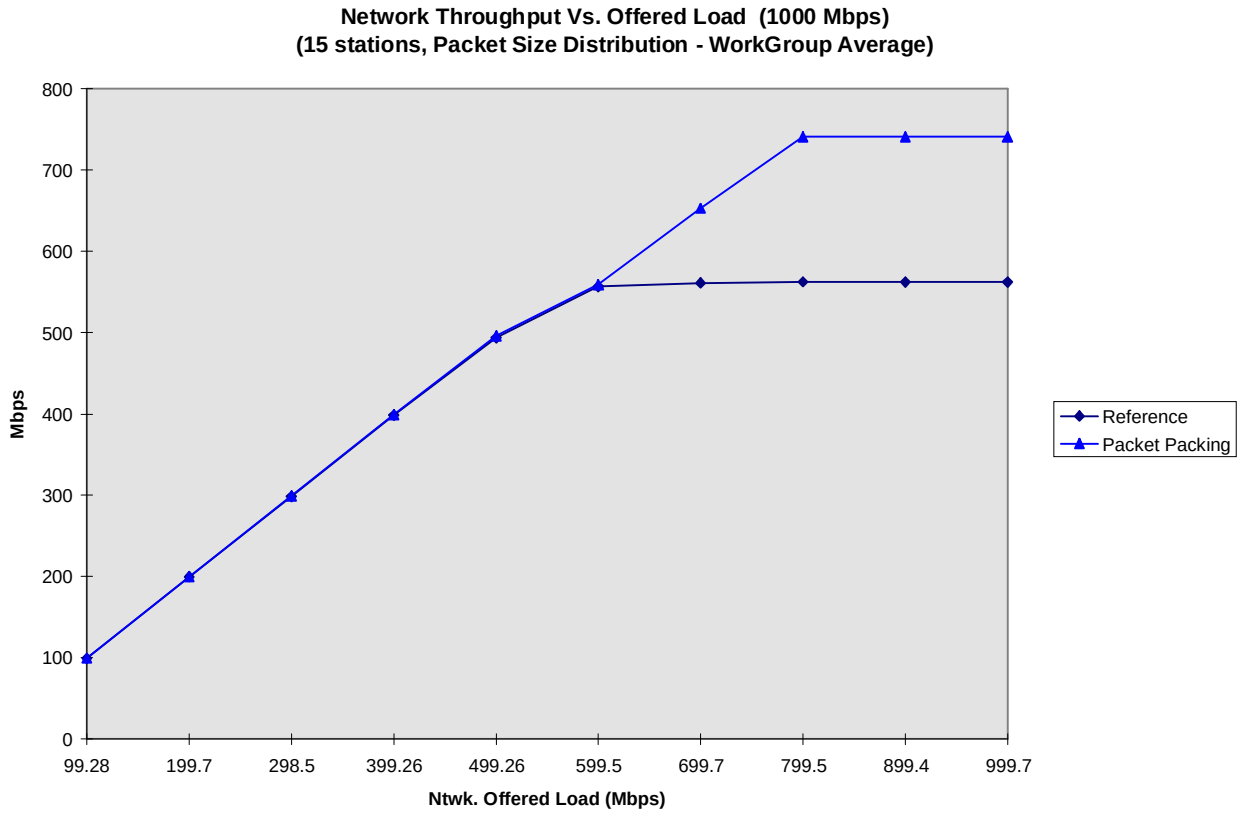
15 Stations, 100% offered load, Total Network Throughput

Packet Size	*Reference*	*Packet Packing*
64 bytes	*90.68 Mbps*	*339.84 Mbps*
1500 bytes	*853.20 Mbps*	*853.20 Mbps*
Workgroup Distribution[1]	*562.19 Mbps*	*740.80 Mbps*

1. Distribution data collected by Howard Frazier that averaged workgroup traffic across 10Mbps and 100Mbps networks

Observations

- Packet packing offers a significant performance boost for worst-case (64 bytes) at all network offered loads
- For workgroup-type distributions, improvement occurs only at high offered loads
- Packet packing has no effect on data throughput for large packet sizes
- Packet Packing increases capture effect minimally
  - Maximum of 5 (for 64 byte packets)
- Packet packing requires possible retransmission of several packets, not just one.


Network Throughput Vs. Offered Load (1000 Mbps)
(15 stations, Packet Size Distribution - WorkGroup Average)
800
700
600
500
400
300
200
100
0
Mbps
99.28
199.7
298.5
399.26
499.26
599.5
699.7
799.5
899.4
999.7
Ntwk. Offered Load (Mbps)
Reference
Packet Packing

*m*TBEB Description

- **Due to the increase in slot time (512 bits -> 512 bytes), decreasing the backoff time may mitigate capture effect**
- **Backoff time is the number of slot intervals r, where:**

$$0 <= r < 2^{k} \; ; k = min (n, 10)$$

- **Change to:**

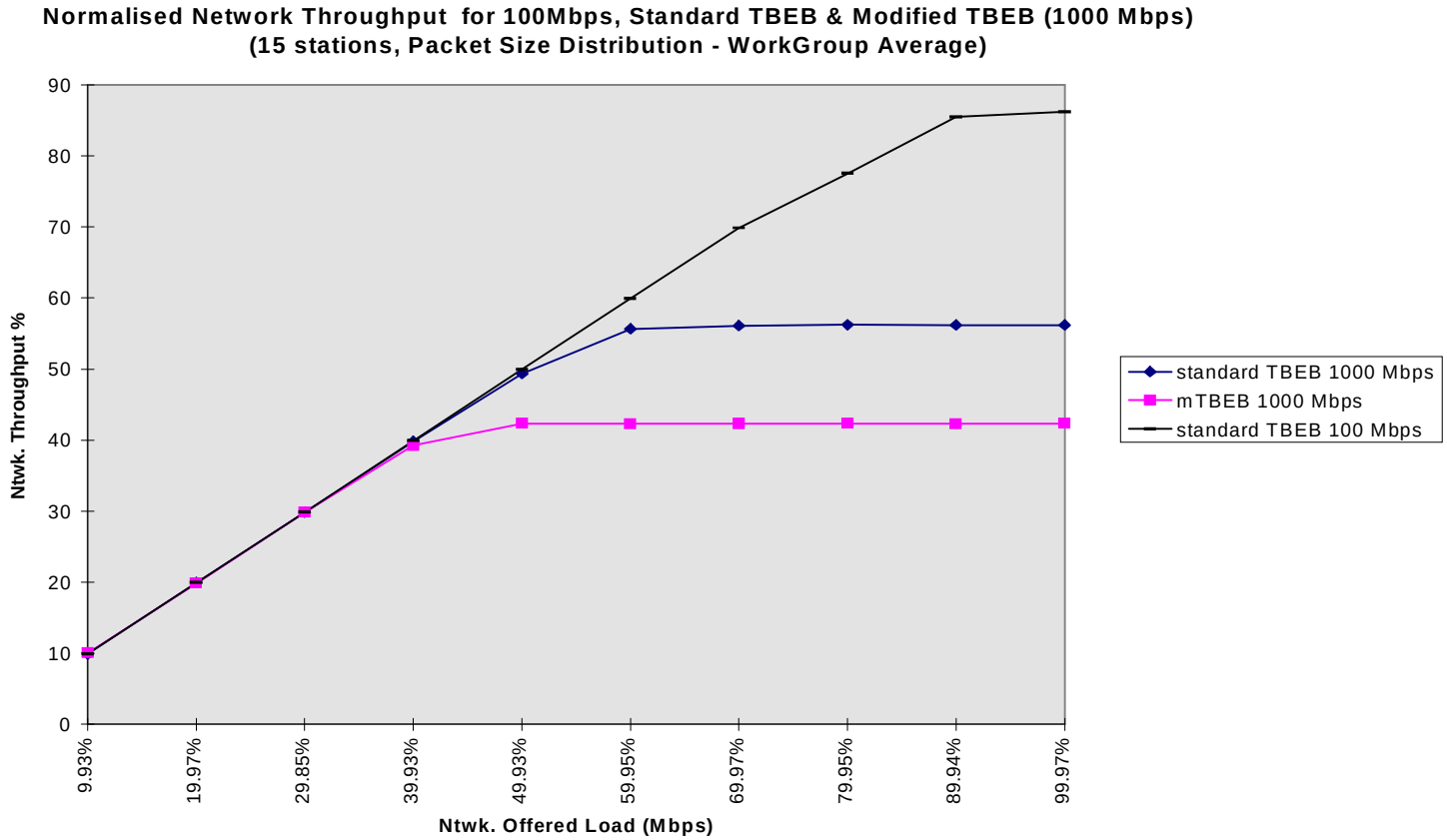
$$0 <= r < 2^{k} \; ; k = min (n, 7)$$

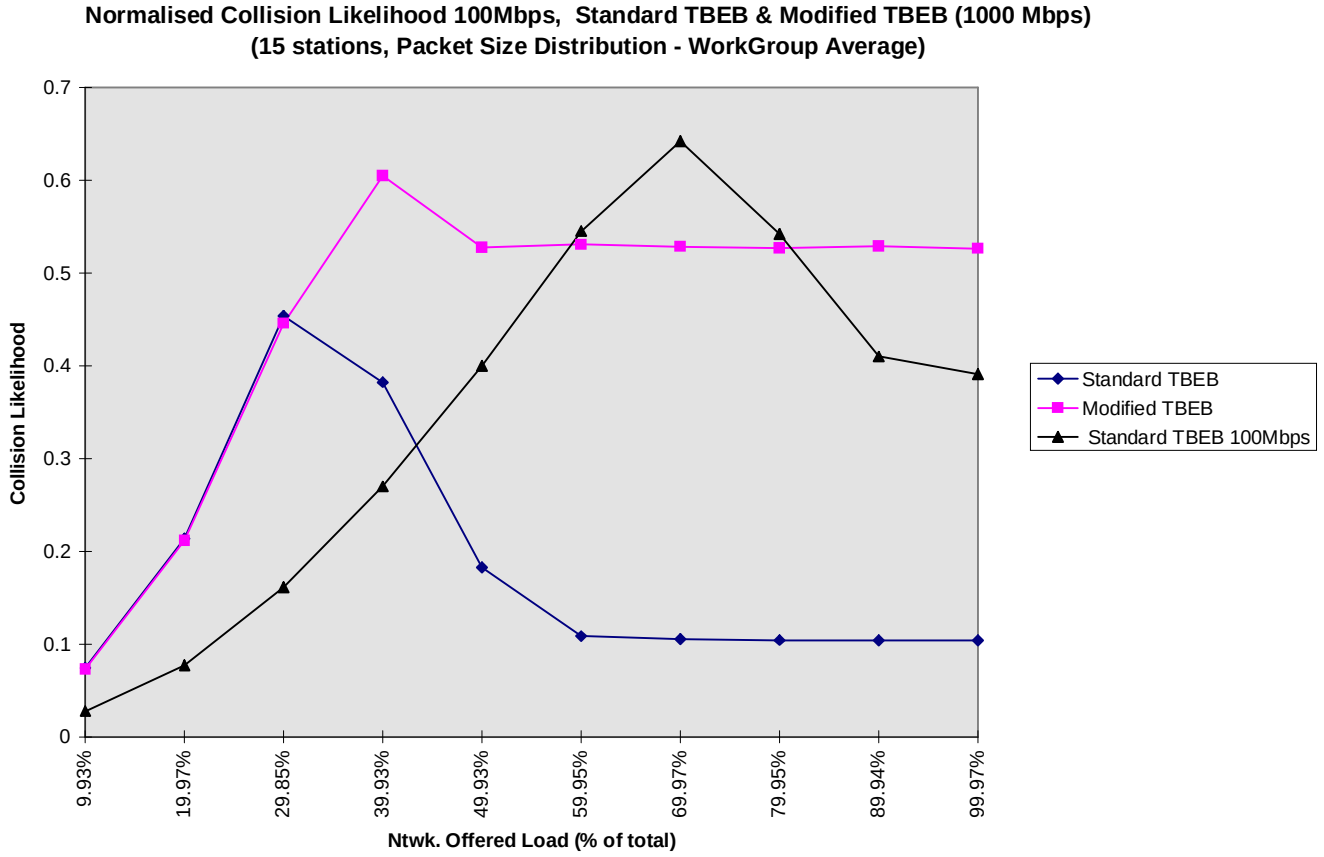
Modified TBEB Observations

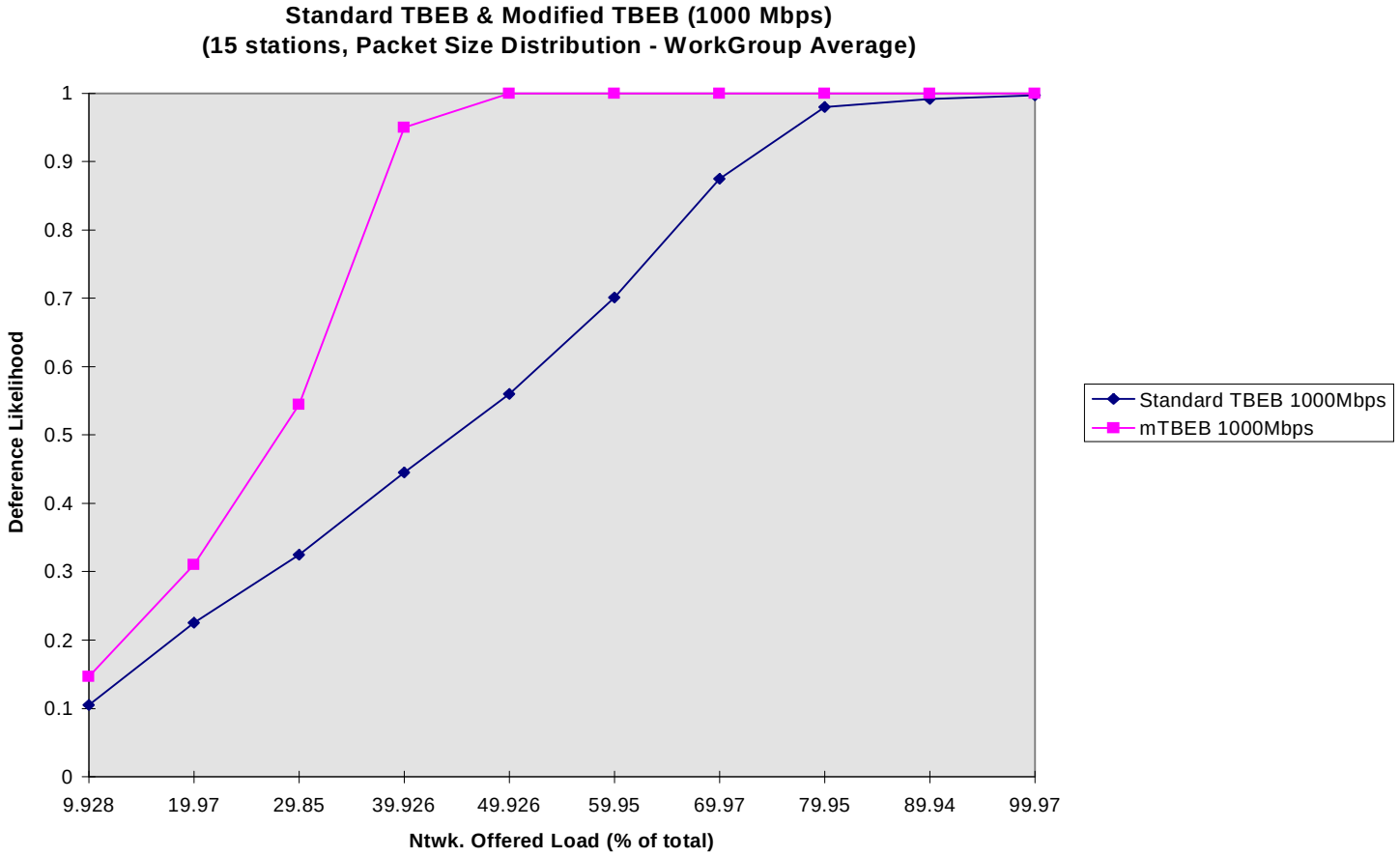
- **Decreasing *n* to 7 worsens all measures of performance with respect to n = 10 at 1000 Mbps except capture effect and access latency**
- **Capture effect is reduced due to the fact that stations contend more aggressively**
  - **– Backoff occurs over a fewer number of bins (128 vs. 1024)**
  - **– For similar conditions (100% offered load, etc., maximum consecutive packets transmitted is 10% of TBEB)**

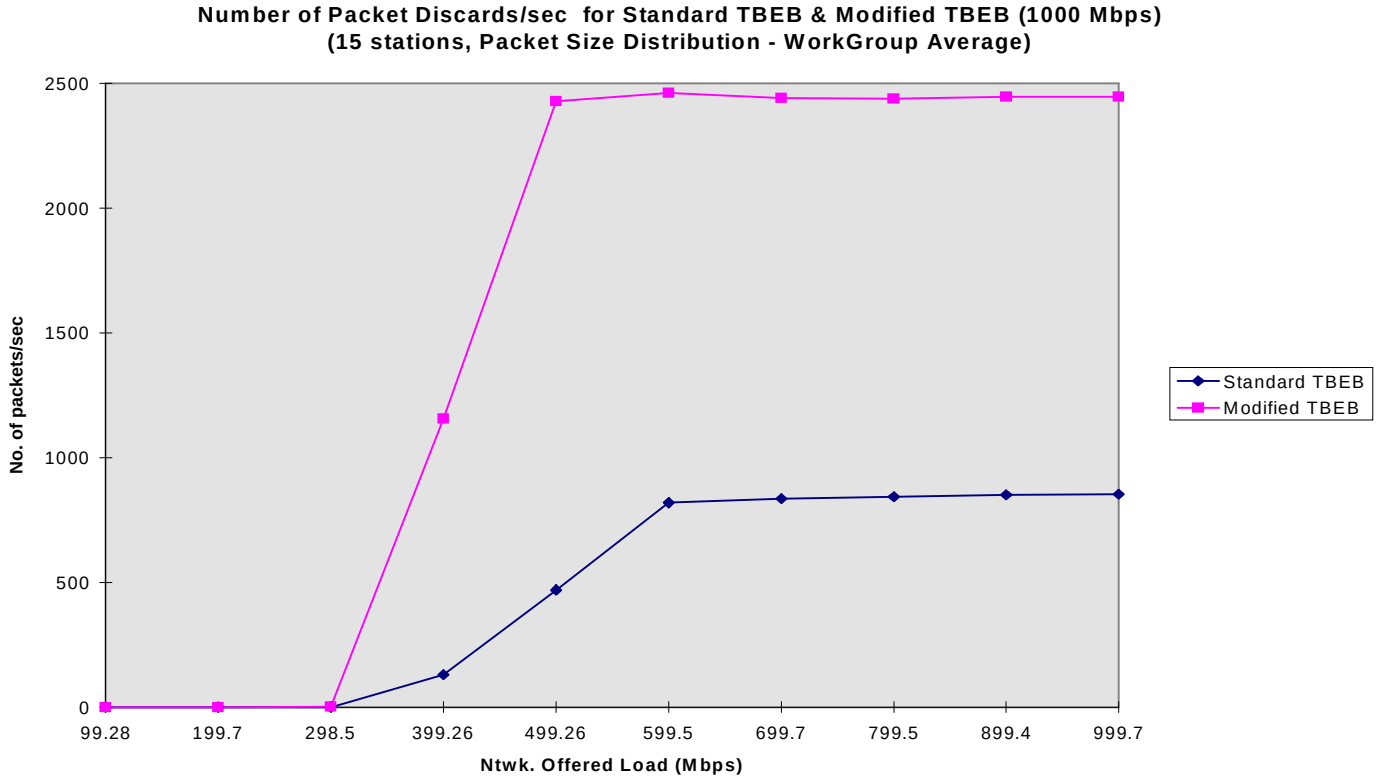
Modified TBEB Observations

- As n increases, capture effect is expected to worsen.
- Inverse relationship between throughput and capture effect as n varies


Normalised Network Throughput for 100Mbps, Standard TBEB & Modified TBEB (1000 Mbps)
(15 stations, Packet Size Distribution - WorkGroup Average)
Ntwk. Throughput %
0
10
20
30
40
50
60
70
80
90
9.93%
19.97%
29.85%
39.93%
49.93%
59.95%
69.97%
79.95%
89.94%
99.97%
Ntwk. Offered Load (Mbps)
standard TBEB 1000 Mbps
mTBEB 1000 Mbps
standard TBEB 100 Mbps


Normalised Collision Likelihood 100Mbps, Standard TBEB & Modified TBEB (1000 Mbps)
(15 stations, Packet Size Distribution - WorkGroup Average)
Collision Likelihood
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
9.93%
19.97%
29.85%
39.93%
49.93%
59.95%
69.97%
79.95%
89.94%
99.97%
Ntwk. Offered Load (% of total)
Standard TBEB
Modified TBEB
Standard TBEB 100Mbps


Standard TBEB & Modified TBEB (1000 Mbps)
(15 stations, Packet Size Distribution - WorkGroup Average)
Deference Likelihood
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
9.928
19.97
29.85
39.926
49.926
59.95
69.97
79.95
89.94
99.97
Ntwk. Offered Load (% of total)
Standard TBEB 1000Mbps
mTBEB 1000Mbps


Number of Packet Discards/sec for Standard TBEB & Modified TBEB (1000 Mbps)
(15 stations, Packet Size Distribution - WorkGroup Average)
No. of packets/sec
2500
2000
1500
1000
500
0
99.28
199.7
298.5
399.26
499.26
599.5
699.7
799.5
899.4
999.7
Ntwk. Offered Load (Mbps)
Standard TBEB
Modified TBEB