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Choice of a Medium Access Control Protocol for HFC Networks

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Choice of a MAC Protocol for HFC Networks- LANMAN'98-1


Motivation

- Conduct a comparative performance evaluation between IEEE 802.14 and SCTE/MCNS MAC protocol solutions.
- Which MAC solution is best suited for HFC networks?
- Which of the MAC protocols best supports QOS in particular CBR end-to-end delay bounds and jitter?

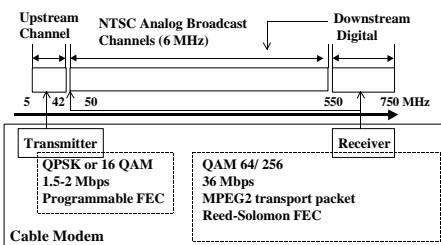

Choice of a MAC Protocol for HFC Networks- LANMAN'98-2


Services over Cable Modem

<p>Asymmetric applications</p> <ul style="list-style-type: none"> • Internet Access • Multimedia information services • Directory services • Home shopping • Surveillance/home security • News entertainment • Archives/Library 	<p>Symmetric applications</p> <ul style="list-style-type: none"> • Email • Videoconferencing • Video phone • Voice • Interactive gaming
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Choice of a MAC Protocol for HFC Networks- LANMAN'98-3

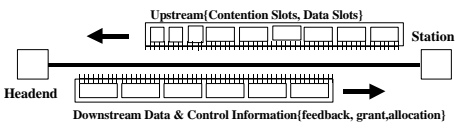
CATV Cable Spectrum





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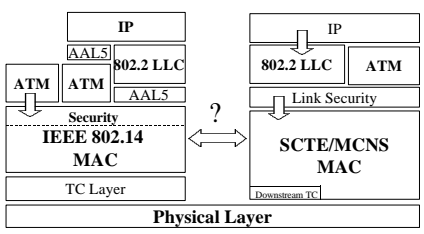
System Model Overview


- Asymmetric
 - Downstream: one to many
 - Upstream: many to one




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IEEE 802.14 Vs SCTE/MCNS: Protocol Stack




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IEEE 802.14 Vs SCTE/MCNS: MAC Considerations

Major differences in the MAC layer make the two specifications incompatible; for example:

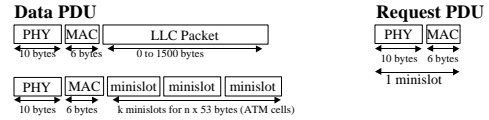
- ATM cell transfer (802.14) Vs 802.2 (LLC) packet transfer (SCTE/MCNS)
- Contention resolution: binary exponential backoff (SCTE), n-ary tree algorithm with priority and FIFO access (802.14).
- Request/Grant messages



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IEEE 802.14 Vs SCTE/MCNS: Framing Structure

SCTE/MCNS



IEEE 802.14



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Simulation Study

- Experiment -1: Contention resolution comparison, ternary-tree Vs binary exponential backoff using ATM cell transfer and the same framing structure.
- Experiment - 2: ATM cell transfer (on-off sources).
- Experiment - 3: Variable packet size transfer (on-off sources with packet size distribution: 48 bytes (60%), 96 bytes (6%), 240 bytes (4%), 528 bytes (2%), 1056 bytes (25%), 1536 bytes (3%))
- Experiment - 4: CBR end-to-end CDV with 20 CBR sources (10% of total load) and on-off background traffic.



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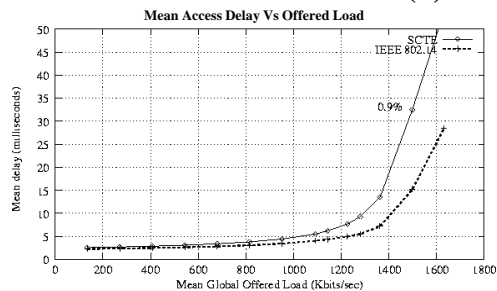
Simulation Parameters

- Max RTD 80 km.
- Upstream transmission is 3 Mbits/s
- Prop. Delay is 5 μ s/km.
- 1.53 ms MAC Req./Reservation cycle
- Variable number of CS/DS in each cycle.
- DS/CS ratio size is 4:1
- 16 bytes minislot size
- Maximum request size is 32.
- Length of simulation run is 30 seconds.
- Initial exponential backoff (SCTE) is $2^{**}4 = 16$ CS.
- Maximum exponential backoff (SCTE) is $2^{**}8 = 256$ CS.
- Number of retries before dropping packet (SCTE) is 16.
- 0 ms HE processing delay



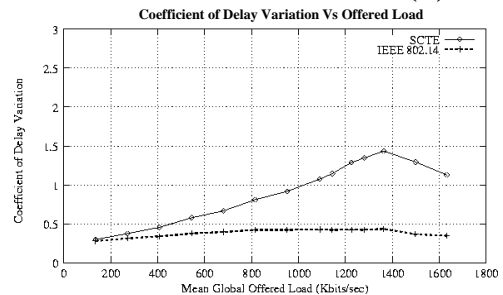
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Experiment- 1: Contention Resolution (a)

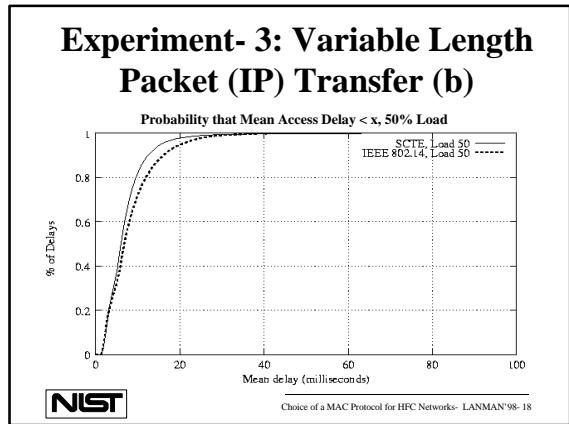
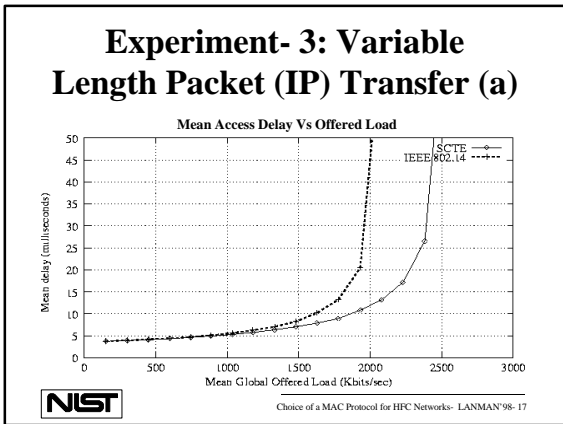
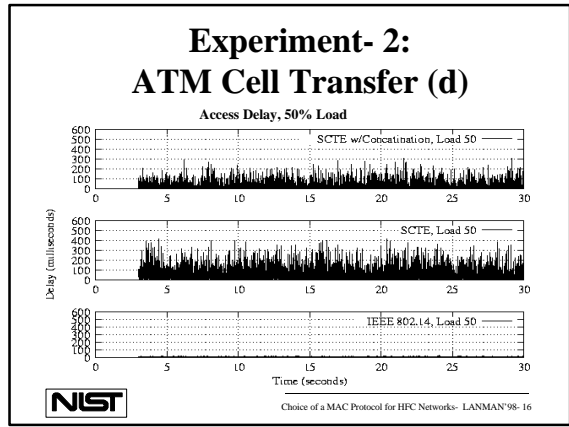
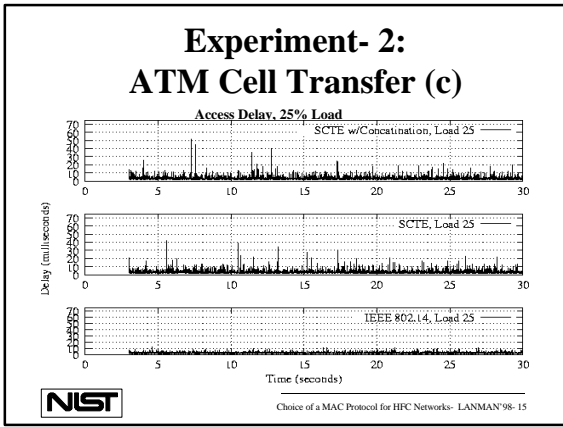
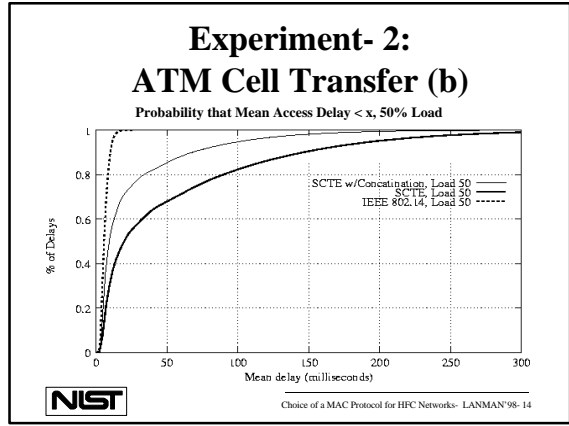
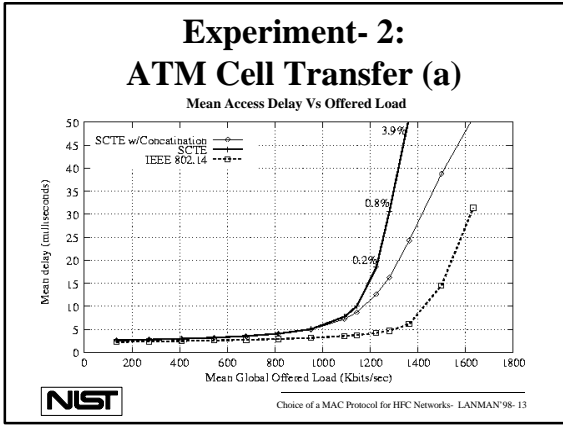


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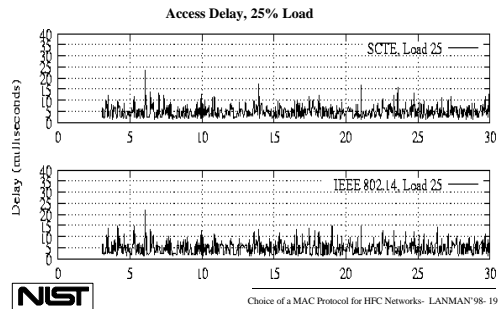
Experiment- 1: Contention Resolution (b)



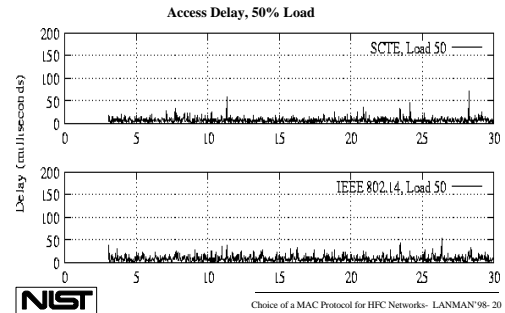
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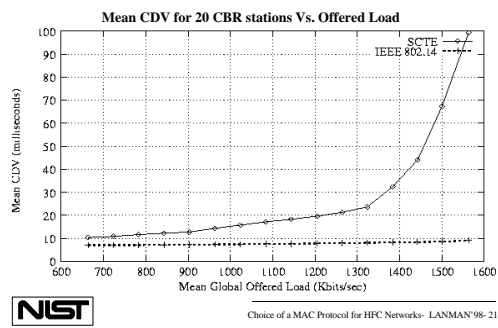
Experiment- 3: Variable Length Packet (IP) Transfer (c)



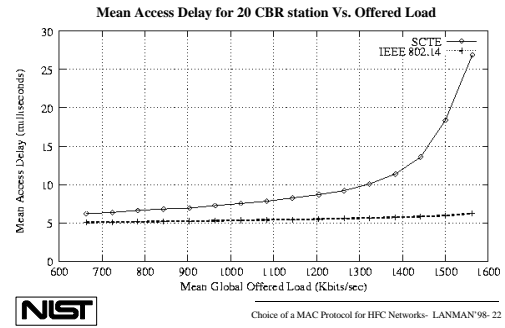
Experiment- 3: Variable Length Packet (IP) Transfer (d)



Experiment - 4: CBR End-to-end CDV



Experiment - 4: CBR End-to-end CDV



Conclusions

- **SCTE:**
 - efficient transfer of IP packets.
 - significant delay variation that will impact QOS.
 - **IEEE 802.14:**
 - ATM friendly environment.
 - QOS support.
- = > **Trade-off between simpler SCTE MAC protocol that works well in an IP environment and IEEE 801.4 that provides good ATM and QOS support.**

