ECSE-4670: Computer Communication Networks (CCN)

Informal Quiz 3

Shivkumar Kalyanaraman: shivkuma@ecse.rpi.edu
Biplab Sikdar: sikdab@rpi.edu

Rensselaer

RSVP

T F

☐ ☐ Slotted ALOHA has improved utilization since the window of vulnerability is halved compared to pure ALOHA.

☐ ☐ CSMA/CD is likely to be much better than CSMA when t_prop/t_trans >1

☐ ☐ The logical bus model used in Ethernet implies that the channel is used in a half-duplex mode.

☐ ☐ Hubs connect two collision domains, whereas bridges connect two broadcast domains.

☐ ☐ Bridges and switches in Ethernet allow separation of collision domains, and reduce the degree of sharing of the physical media.

☐ ☐ 100Base-T was made possible because the maximum segment length necessary in UTP tree architectures was 100m.

☐ ☐ The smallest valid Type field in the Ethernet header is 0x0800 because of interoperability concerns with IEEE 802.3 which has a MTU of 1518 bytes

☐ ☐ The reason Ethernet has a minimum frame size is to guarantee detection of collision (or the lack of it) before the end of frame transmission

☐ ☐ The reason a collection of bridged collision domains do not scale is because the probability of broadcasts (by nodes or bridges) increases.

- ☐ ☐ Randomness (in service and arrival) is what causes queuing at buffers.
- ☐ ☐ The inter-arrival times of a poisson arrival process are exponentially distributed.
- ☐ ☐ The P-K formula for M/G/1 queuing systems reduces to the E(n) formulas for M/M/1 and M/D/1 if we substitute the value for σ^2 (I.e. $\sigma^2 = 1/\mu^2$ and $\sigma^2 = 0$ for exponential deterministic service processes respectively)
- ☐ ☐ The throughput of a M/M/1/N system is the same as that of an M/M/1 system
- ☐ ☐ The blocking probability of a M/M/1/N system can be approximated by that of an M/M/1 system for small buffer sizes
- ☐ ☐ The number of packets in an M/M/1 system is $\Sigma n(1-\rho)\rho^n$ which can be written as $(1-\rho)\rho * d/d\rho\{\Sigma \rho^{n-1}\} = \rho/(1-\rho)$

- ☐ ☐ Little's law which relates expected queuing delay E(T) and expected number in the system E(n) is applicable only to M/M/1 queues (I.e. it cannot be applied to M/G/1 and D/D/1 systems)
- ☐ ☐ Little's law also applies to *instantaneous* (as opposed to average) queuing delay and instantaneous number in the system.
- ☐ ☐ The "number of packets in the system" refers to the number of packets waiting in the queue plus the number of packets in service.
- ☐ ☐ In an M/M/1 system with λ = 1000 bits/s and μ = 900 bits/s, the expected delay E(T) is 5 seconds.
- ☐ ☐ Once a telephone circuit is established, voice samples which are switched see no (waiting) delay because it is a D/D/1 system
- ☐ ☐ The P-K formulas (for E(n)) for M/G/1 systems tells us that queues and queuing delay increases dramatically as utilization $\rho > 0.9$ and as the variance of the service times σ^2 increases.
- ☐ ☐ An M/G/1 system with service rate of 10 Mbps is likely to have smaller queues than a similar system with a service rate of 1Mbps, assuming other parameters are equal.
- ☐ ☐ Larger queues (I.e. larger E(n), as may happen in higher speed bottlenecks) does not necessarily imply larger queuing delay (I.e. larger E(T))

- ☐ ☐ The M/M/k/k system and the Erlang formula models the probability of your phone call being connected (I.e. not blocked).
- ☐ ☐ At light loads, an M/D/1 system has half the queues as an M/M/1 system, and at heavy loads, both of them have nearly equal queues.
- ☐ ☐ Consider a point-to-point link with no multiple-access, bit-errors or flow-control issues. Framing is not required for such a link.
- ☐ ☐ Parity (odd or even) works because it transforms the transmitted bits into codewords with a Hamming distance of 2.
- ☐ ☐ CRC is based upon the idea that it is highly unlikely for an uncorrupted packet (including CRC bits) to be perfectly divisible (I.e. zero remainder) by the CRC polynomial.
- ☐ ☐ The set of bits in the CRC field is the remainder of the following division operation: D·2r/G, where D is the set of data bits, and G is a r+1 bit generator pattern.
- ☐ ☐ Channel partitioning MAC protocols can lead of waste of bandwidth if some users do not use their allocations.

- □ Random access MAC protocols tend to perform very well at low loads in terms of channel multiplexing; but suffers from high delay at high loads.
- □ "Taking turns" or token-based protocols like token-ring offer a best of both partitioning and random access worlds.
- □ In Local area networks, t_prop/t_trans < 1, and number of users accessing the channel is not too large.
- □ TDMA is simply a distributed form of TDM scheduling (which does not allow statistical multiplexing); token-passing is simply a distributed form of round-robin scheduling (which allows statistical multiplexing); random access is similar to a distributed version of FCFS, with adjustments for collisions.
- □ The primary reasons a bus-protocol for LANs is different from that of a computer bus is because of distance and the number of nodes attached.
- □ The suitability of MAC protocols to a particular scenario depends upon the expected utilization levels, number of users, distances (I.e. propagation delay), transmission speeds (I.e. transmission delays), and the complexity of protocol mechanisms. This is why we have a slew of MAC protocols for a variety of applications from Ethernet to Wireless LANs to satellite networks to cable networks.

- ☐ ☐ CDMA divides frequency into multiple bands and has users transmitting in an assigned band only.
- ☐ ☐ Orthogonal CDMA codes lead to interference in transmission.
- ☐ ☐ Fixed-channel assignment protocols for packet switched data (with markovian arrival/service distribution) leads to a reduction in average delay by a factor of N.
- ☐ ☐ Slotted ALOHA has a maximum utilization of 18%.
- ☐ ☐ Slotted ALOHA increases utilization over unslotted ALOHA because it does not allow collisions to occur between users who arrive in adjacent time slots.
- ☐ ☐ The CSMA part of Ethernet uses p-persistent transmission with a p of 0.5.
- ☐ ☐ The collision detection part of Ethernet really pays off in practice because average transmission time >> propagation time.
- ☐ ☐ In Ethernet, all nodes detect collision at precisely the same time instant.
- ☐ ☐ In Ethernet, a node which sees collision and backs off tends to remain in backoff phases if other nodes which have not seen a collision are constantly accessing the channel (a.k.a. the "capture" effect).
- ☐ ☐ Ethernet uses a linear backoff system when it detects collision.

- ☐ ☐ Token ring is essentially a distributed polling implementation where the revolving token polls a node to see if it has something to transmit.
- ☐ ☐ Token-based protocols cannot be implemented on a bus-architecture.
- ☐ ☐ Reservation protocols cannot be implemented on a ring architecture.
- ☐ ☐ Ethernet succeeded in the real-world because the protocol was flexible enough to be applied to a variety of media and topology architectures, especially the tree architectures which could leverage the existing PBX twisted pair wiring & conduits in buildings.
- ☐ ☐ Ethernet has a minimum packet size because the transmission of packet at the source node without hearing a collision is assumed to be an acknowledgement of the transmission (I.e. no collisions are allowed to happen if the source has not heard it till end of packet transmission).
- ☐ ☐ Token ring has a minimum packet size of 64 bytes.
- ☐ ☐ CRC bits are placed at the end of the packet (I.e. as a "trailer" instead of at the "header"), because the CRC can be calculated as the packet bits are processed, and be appended to the end.
- ☐ ☐ Hubs isolate collision domains.
- ☐ ☐ Routers are placed at the border of broadcast domains.
- ☐ ☐ The 10BaseT notation represents 100 Mbps Ethernet operating over coaxial cable.

- ☐ Hubs are essentially repeaters with multiple ports, I.e., they operate at layer 1, regenerate and broadcast signals to all the connected ports.
- ☐ ”Full-duplex” “Point-to-point” Gigabit Ethernet implies that only the Ethernet framing format is used, but the CSMA/CD protocol is not used (coz CSMA/CD assumes a “half-duplex” and “multiple-access” channel)
- ☐ Layer 2 switches are just bridges with a high speed switching fabric (I.e. high speed parallel forwarding).
- ☐ The primarily difference between interconnection devices at Layer 1 (hubs, repeaters), Layer 2 (bridges) and Layer 3 (routers) is the degree and intelligence of filtering packets. Their efficiency of filtering also fundamentally limits their scalability.
- ☐ Bridges’ filtering capability is through a “learning” algorithm where the bridge snoops on passing packets and determines which side a node lies. In the absence of any packets seen, a bridge resorts to flooding – something a router (I.e. layer 3 device) will never do .
- ☐ The purpose of a dynamically constructed spanning tree between bridges is to limit the scope of flooded packets so that they don’t appear on the same LAN twice.
- ☐ The 802.11 wireless LAN MAC protocol uses CSMA/CA instead of CSMA/CD because collisions can be heard only at the receiver (and not at the source node) because of the hidden terminal problem.

Solutions

T F

√ ☐ Slotted ALOHA has improved utilization since the window of vulnerability is halved compared to pure ALOHA.

☐ √ CSMA/CD is likely to be much better than CSMA when t_prop/t_trans >1

√ ☐ The logical bus model used in Ethernet implies that the channel is used in a half-duplex mode.

☐ √ Hubs connect two collision domains, whereas bridges connect two broadcast domains.

√ ☐ Bridges and switches in Ethernet allow separation of collision domains, and reduce the degree of sharing of the physical media.

√ ☐ 100Base-T was made possible because the maximum segment length necessary in UTP (twisted pair) tree architectures was 100m.

√ ☐ The smallest valid Type field in the Ethernet header is 0x0800 because of interoperability concerns with IEEE 802.3 which has a MTU of 1518 bytes

√ ☐ The reason Ethernet has a minimum frame size is to guarantee detection of collision (or the lack of it) before the end of frame transmission

√ ☐ The reason a collection of bridged collision domains do not scale is because the probability of broadcasts (by nodes or bridges) increases.

- √ ☐ Randomness (in service and arrival) is what causes queuing at buffers.
- √ ☐ The inter-arrival times of a poisson arrival process are exponentially distributed.
- √ ☐ The P-K formula for M/G/1 queuing systems reduces to the E(n) formulas for M/M/1 and M/D/1 if we substitute the value for σ^2 (I.e. $\sigma^2 = 1/\mu^2$ and $\sigma^2 = 0$ for exponential deterministic service processes respectively)
- ☐ √ The throughput of a M/M/1/N system is the same as that of an M/M/1 system
- √ ☐ The blocking probability of a M/M/1/N system can be approximated by that of an M/M/1 system for small buffer sizes
- √ ☐ The number of packets in an M/M/1 system is $\Sigma n(1-\rho)\rho^n$ which can be written as $(1-\rho)\rho * d/d\rho\{\Sigma \rho^{n-1}\} = \rho/(1-\rho)$

- □ √ Little's law which relates expected queuing delay E(T) and expected number in the system E(n) is applicable only to M/M/1 queues (I.e. it cannot be applied to M/G/1 and D/D/1 systems)
- □ √ Little's law also applies to *instantaneous* (as opposed to average) queuing delay and instantaneous number in the system.
- √ □ The "number of packets in the system" refers to the number of packets waiting in the queue plus the number of packets in service.
- □ √ In an M/M/1 system with λ = 1000 bits/s and μ = 900 bits/s, the expected delay E(T) is 5 seconds.
- √ □ Once a telephone circuit is established, voice samples which are switched see no (waiting) delay because it is a D/D/1 system
- √ □ The P-K formulas (for E(n)) for M/G/1 systems tells us that queues and queuing delay increases dramatically as utilization $\rho > 0.9$ and as the variance of the service times σ^2 increases.
- □ √ An M/G/1 system with service rate of 10 Mbps is likely to have smaller queues than a similar system with a service rate of 1Mbps, assuming other parameters are equal.
- √ □ Larger queues (I.e. larger E(n), as may happen in higher speed bottlenecks) does not necessarily imply larger queuing delay (I.e. larger E(T))

- √ ☐ The M/M/k/k system and the Erlang formula models the probability of your phone call being connected (I.e. not blocked).
- ☐ √ At light loads, an M/D/1 system has half the queues as an M/M/1 system, and at heavy loads, both of them have nearly equal queues.
- ☐ √ Consider a point-to-point link with no multiple-access, bit-errors or flow-control issues. Framing is not required for such a link.
- √ ☐ Parity (odd or even) works because it transforms the transmitted bits into codewords with a Hamming distance of 2.
- √ ☐ CRC is based upon the idea that it is highly unlikely for an uncorrupted packet (including CRC bits) to be perfectly divisible (I.e. zero remainder) by the CRC polynomial.
- √ ☐ The set of bits in the CRC field is the remainder of the following division operation: D·2r/G, where D is the set of data bits, and G is a r+1 bit generator pattern.
- √ ☐ Channel partitioning MAC protocols can lead of waste of bandwidth if some users do not use their allocations.

- √ ☐ Random access MAC protocols tend to perform very well at low loads in terms of channel multiplexing; but suffers from high delay at high loads.
- √ ☐ "Taking turns" or token-based protocols like token-ring offer a best of both partitioning and random access worlds.
- √ ☐ In Local area networks, t_prop/t_trans < 1, and number of users accessing the channel is not too large.
- √ ☐ TDMA is simply a distributed form of TDM scheduling (which does not allow statistical multiplexing); token-passing is simply a distributed form of round-robin scheduling (which allows statistical multiplexing); random access is similar to a distributed version of FCFS, with adjustments for collisions.
- √ ☐ The primary reasons a bus-protocol for LANs is different from that of a computer bus is because of distance and the number of nodes attached.
- √ ☐ The suitability of MAC protocols to a particular scenario depends upon the expected utilization levels, number of users, distances (I.e. propagation delay), transmission speeds (I.e. transmission delays), and the complexity of protocol mechanisms. This is why we have a slew of MAC protocols for a variety of applications from Ethernet to Wireless LANs to satellite networks to cable networks.

☐ √ CDMA divides frequency into multiple bands and has users transmitting in an assigned band only.

☐ √ Orthogonal CDMA codes lead to interference in transmission.

☐ √ Fixed-channel assignment protocols for packet switched data (with markovian arrival/service distribution) leads to a reduction in average delay by a factor of N.

☐ √ Slotted ALOHA has a maximum utilization of 18%.

√ ☐ Slotted ALOHA increases utilization over unslotted ALOHA because it does not allow collisions to occur between users who arrive in adjacent time slots.

☐ √ The CSMA part of Ethernet uses p-persistent transmission with a p of 0.5.

√ ☐ The collision detection part of Ethernet really pays off in practice because average transmission time >> propagation time.

☐ √ In Ethernet, all nodes detect collision at precisely the same time instant.

√ ☐ In Ethernet, a node which sees collision and backs off tends to remain in backoff phases if other nodes which have not seen a collision are constantly accessing the channel (a.k.a. the "capture" effect).

☐ √ Ethernet uses a linear backoff system when it detects collision.

- √ ☐ Token ring is essentially a distributed polling implementation where the revolving token polls a node to see if it has something to transmit.
- ☐ √ Token-based protocols cannot be implemented on a bus-architecture.
- ☐ √ Reservation protocols cannot be implemented on a ring architecture.
- √ ☐ Ethernet succeeded in the real-world because the protocol was flexible enough to be applied to a variety of media and topology architectures, especially the tree architectures which could leverage the existing PBX twisted pair wiring & conduits in buildings.
- √ ☐ Ethernet has a minimum packet size because the transmission of packet at the source node without hearing a collision is assumed to be an acknowledgement of the transmission (I.e. no collisions are allowed to happen if the source has not heard it till end of packet transmission).
- ☐ √ Token ring has a minimum packet size of 64 bytes.
- √ ☐ CRC bits are placed at the end of the packet (I.e. as a “trailer” instead of at the “header”), because the CRC can be calculated as the packet bits are processed, and be appended to the end.
- ☐ √ Hubs isolate collision domains.
- √ ☐ Routers are placed at the border of broadcast domains.
- ☐ √ The 10BaseT notation represents 100 Mbps Ethernet operating over coaxial cable.

√ ☐ Hubs are essentially repeaters with multiple ports, I.e., they operate at layer 1, regenerate and broadcast signals to all the connected ports.

√ ☐ "Full-duplex" "Point-to-point" Gigabit Ethernet implies that only the Ethernet framing format is used, but the CSMA/CD protocol is not used (coz CSMA/CD assumes a "half-duplex" and "multiple-access" channel)

√ ☐ Layer 2 switches are just bridges with a high speed switching fabric (I.e. high speed parallel forwarding).

√ ☐ The primarily difference between interconnection devices at Layer 1 (hubs, repeaters), Layer 2 (bridges) and Layer 3 (routers) is the degree and intelligence of filtering packets. Their efficiency of filtering also fundamentally limits their scalability.

√ ☐ Bridges' filtering capability is through a "learning" algorithm where the bridge snoops on passing packets and determines which side a node lies. In the absence of any packets seen, a bridge resorts to flooding – something a router (I.e. layer 3 device) will never do .

√ ☐ The purpose of a dynamically constructed spanning tree between bridges is to limit the scope of flooded packets so that they don't appear on the same LAN twice.

√ ☐ The 802.11 wireless LAN MAC protocol uses CSMA/CA instead of CSMA/CD because collisions can be heard only at the receiver (and not at the source node) because of the hidden terminal problem.