Computer Networks

BCST -502 BCSP- 502

B.Tech (CSE) 5th Semester

Course Instructor: Dr Bishwajeet Pandey

New 2020 Syllabus

Unit –I

Computer Network: Definitions, goals, components, Architecture, Classifications & Types.Layered Architecture: Protocol hierarchy, Design Issues, Interfaces and Services, ConnectionOriented & Connectionless Services, Service primitives, Design issues & its functionality. ISOOSI Reference Model: Principle, Model, Descriptions of various layers and its comparison with TCP/IP. Principals of physical layer: Media, Bandwidth, Data rate and Modulations

Unit-II

Data Link Layer: Need, Services Provided, Framing, Flow Control, Error control. Data Link Layer Protocol: Elementary &Sliding Window protocol: 1-bit, Go-Back-N, Selective Repeat, Hybrid ARQ. Protocol verification: Finite State Machine Models & Petri net models. ARP/RARP/GARP

Unit-III

MAC Sub layer: MAC Addressing, Binary Exponential Back-off (BEB) Algorithm, Distributed Random Access Schemes/Contention Schemes: for Data Services (ALOHA and Slotted- ALOHA), for Local-Area Networks (CSMA, CSMA/CD, CSMA/CA), CollisionFree Protocols: Basic Bit Map, BRAP, Binary Count Down, MLMA Limited Contention Protocols: Adaptive Tree Walk, Performance Measuring Metrics. IEEE Standards 802 series & their variant.

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Unit-IV

Network Layer: Need, Services Provided, Design issues, Routing algorithms: Least CostRouting algorithm, Dijkstra's algorithm, Bellman-ford algorithm, Hierarchical Routing,Broadcast Routing, Multicast Routing. IP Addresses, Header format, Packet forwarding,Fragmentation and reassembly, ICMP, Comparative study of IPv4 & IPv6

Unit-V

Transport Layer: Design Issues, UDP: Header Format, Per-Segment Checksum, CarryingUnicast/Multicast Real-Time Traffic, TCP: Connection Management, Reliability of DataTransfers, TCP Flow Control, TCP Congestion Control, TCP Header Format, TCP TimerManagement. Application Layer: WWW and HTTP, FTP, SSH, Email (SMTP, MIME, IMAP), DNS, Network Management (SNMP).

About Course Instructor

- PhD from Gran Sasso Science Institute, Italy
- PhD Supervisor Prof Paolo Prinetto from Politecnico Di Torino, World Rank 13 in Electrical Engineering
- MTech from Indian Institute of Information Technology, Gwalior
- Scopus Profile: https://www.scopus.com/authid/detail.uri?authorId=57203239026
- Google Scholar: https://scholar.google.com/citations?user=UZ_8yAMAAAAJ&hl=hi
- Contact: gyancity@gyancity.com, +91-7428640820 (For help in this Subject @ BIAS and Guidance for future MS from Europe and USA after BIAS)

About Course Outline

- UNIT 1: Lecture No 1-4
- UNIT 2: Lecture No 5-11 (Including Lab on Vivado)
- UNIT 3: Lecture No 14-18
- UNIT 4: Lecture No 19-21, Lecture 12-13
- UNIT 5: Lecture No 22-28 (Including Lab on Packet Tracer)
- Lecture No 29-35: Discuss Previous Year Question of UKTU
- Out of 35 Lectures: Some will delivered by Professor From Foreign University

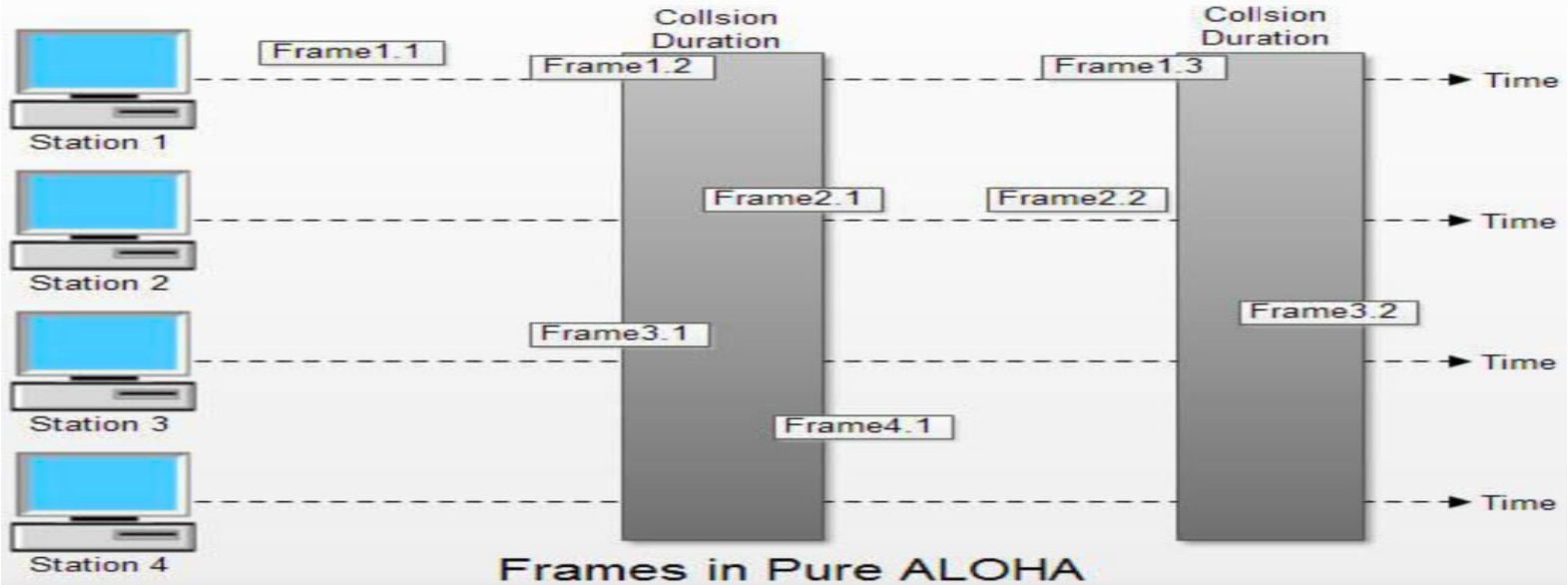
OUTLINE OF LECTURE 15

- Distributed Random Access Schemes/Contention Schemes:
  - For Data Services:
    - ALOHA
    - Slotted-ALOHA
  - For Local-Area Networks:
    - CSMA
    - CSMA/CD
    - CSMA/CA

ALOHA

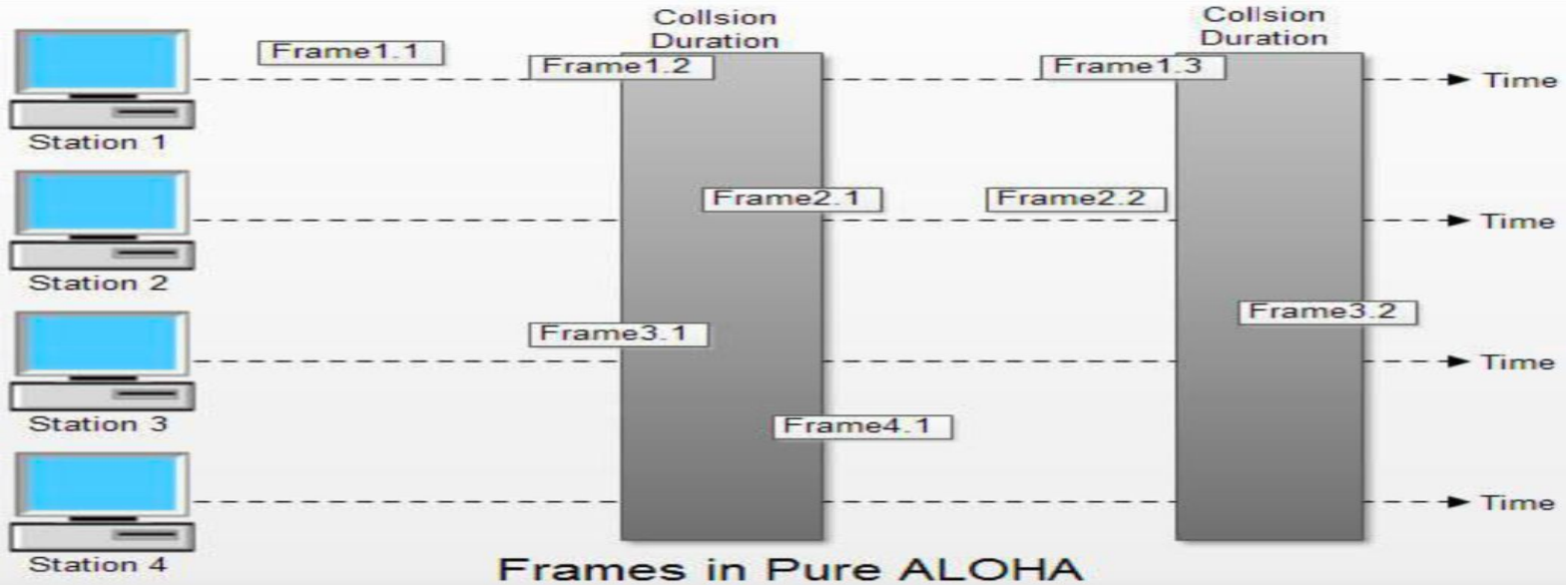
- Applicable to any *contention system*
  - ❑ System in which uncoordinated users are competing for the use of a single shared channel
- Two versions
  - ❑ Pure ALOHA
  - ❑ Slotted ALOHA

PURE ALOHA



- Let users transmit whenever they have data to be sent
- Colliding frames are destroyed

PURE ALOHA



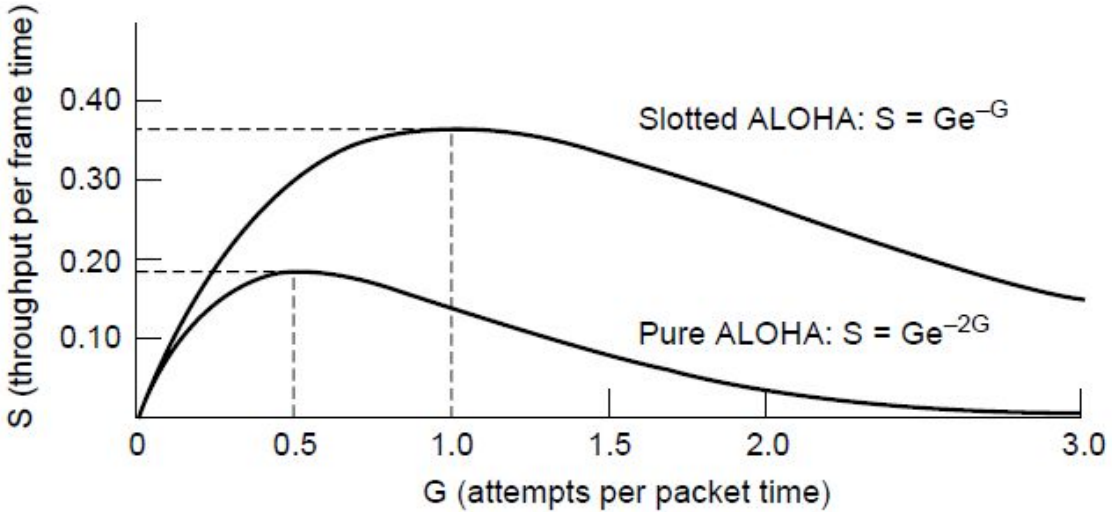
- In fig there are four stations that contended with one another for access to shared channel. All these stations are transmitting frames. Some of these frames collide because multiple frames are in contention for the shared channel. Only two frames, frame 1.1 and frame 2.2 survive. All other frames are destroyed.

SLOTTED ALOHA

- Discrete time
- Agreed slot boundaries
- Synchronization needed
- Performance
  - ❑ Which ALOHA has a shorter medium access delay?
  - ❑ Which ALOHA has a higher throughput?

PERFORMANCE OF ALOHA

- Slotted ALOHA can double the throughput of pure ALOHA

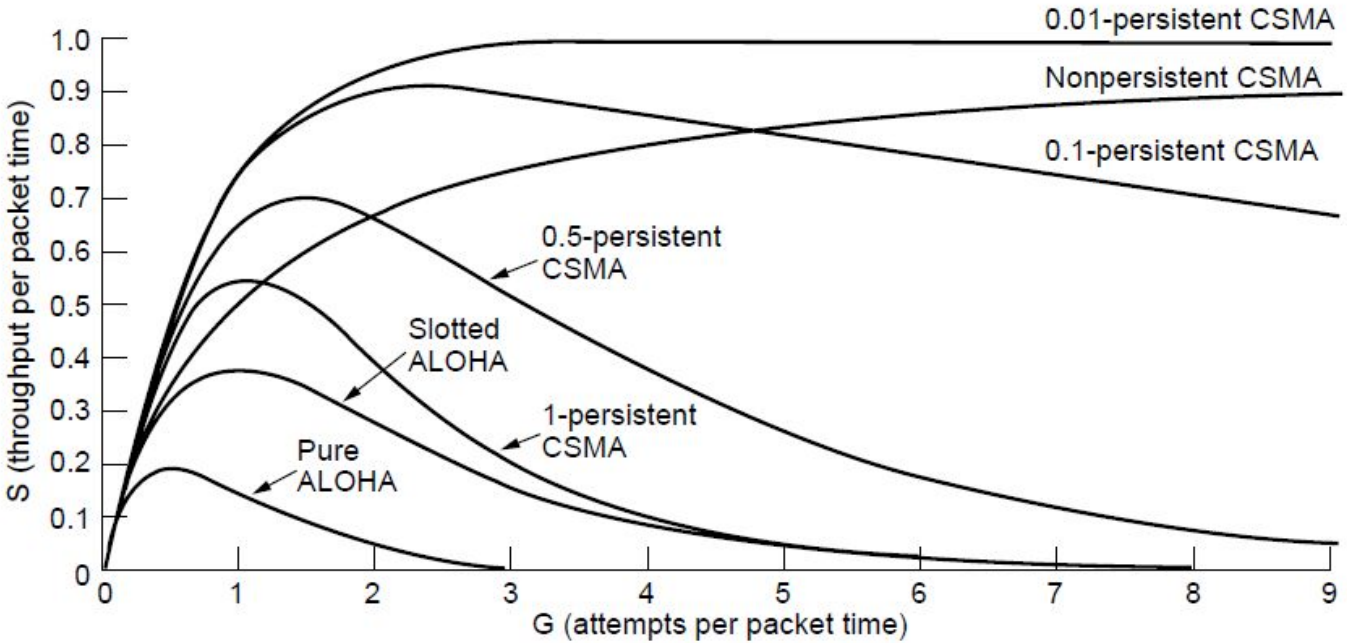


Throughput versus offered traffic for ALOHA systems.

CSMA

- Stations can listen to the channel (i.e., sense a carrier in the channel)
- Types
  - 1-persistent CSMA
  - Nonpersistent CSMA
  - *p*-persistent CSMA

Performance of MAC Protocols



Comparison of the channel utilization

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CSMA/CD Algorithm

- Can listen to the channel and detect collision
  - ❑ Stop transmitting as soon as collision detected
- Widely used on LANs (e.g., Ethernet)
- Collision detection
  - ❑ Analog process
  - ❑ Special encoding is used

CSMA/CD Algorithm

- Conceptual model
  - ❑ 3 states
    - Contention
    - Transmission
    - Idle
- Minimum time to detect collision determines time slot
  - ❑ Depends on propagation delay of medium

CSMA/CD Algorithm

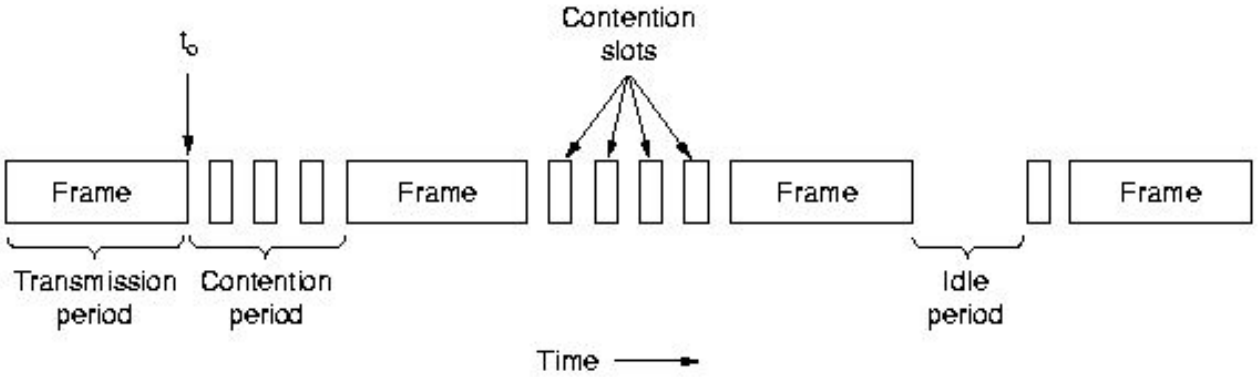
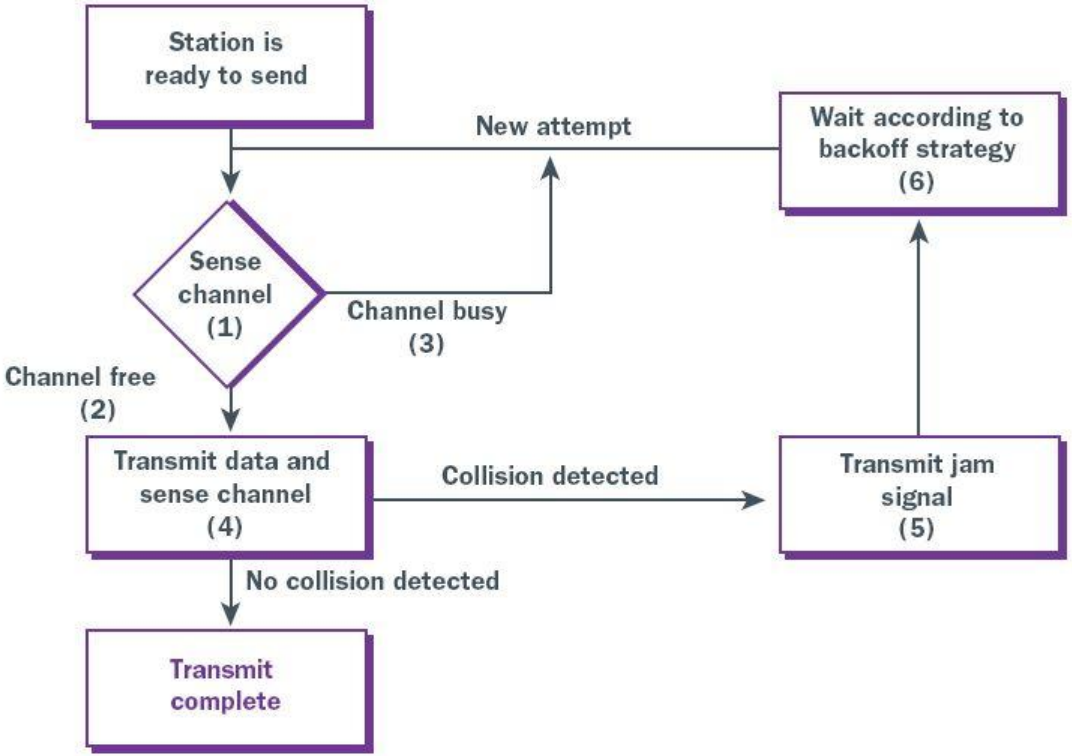


Fig. 4-5. CSMA/CD can be in one of three states: contention, transmission, or idle.

CSMA/CD Algorithm



Source: http://www.10gea.org/gigabit-ethernet/

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CSMA/CA Algorithm

- **Carrier-sense multiple access with collision avoidance** (**CSMA/CA**) in computer networking, is a network multiple access method in which carrier sensing is used, but nodes attempt to avoid collisions by beginning transmission only after the channel is sensed to be "idle".

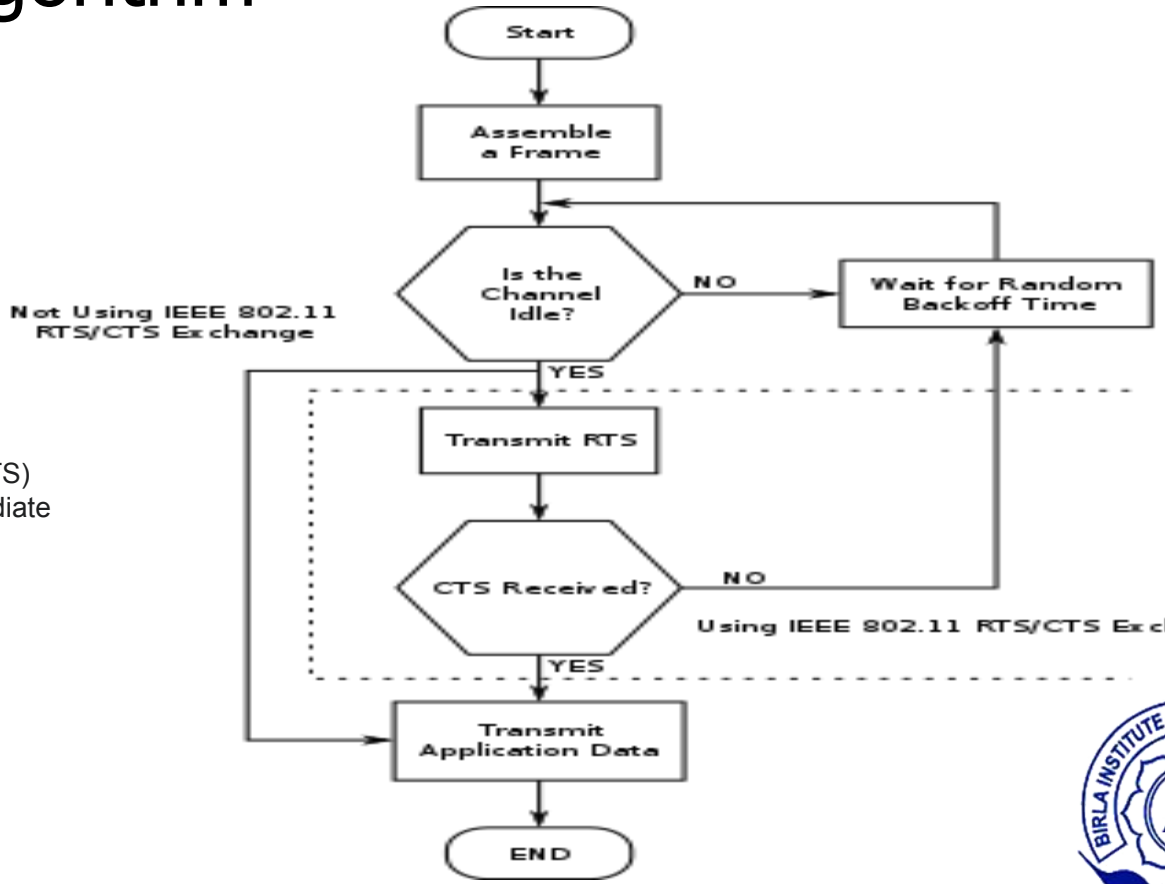
- When they do transmit, nodes transmit their packet data in its entirety.

CSMA/CA Algorithm

- It is particularly important for wireless networks, where the collision detection of the alternative CSMA/CD is not possible due to wireless transmitters desensing their receivers during packet transmission.

- CSMA/CA is unreliable due to the hidden node problem.

CSMA/CA Algorithm



Request to Send/Clear to Send (RTS/CTS) may optionally be used at this point to mediate access to the shared medium.