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Wireless LAN

- Extension of LAN.
- Restricted to buildings, campus, etc. & are operated by individuals & not by large-scale network providers.

* Advantages

- flexibility (no restrictions)
- Planning (no preplanned topology)
- Design (small, independent designs)
- Robustness (less prone to damage)
- Cost (no add-ons for adding new users)
- Ease of use

* Disadvantages

- Quality of service - Offer lower quality than wired counterparts
  - ↳ Lower bandwidth (limitations in radio transmissions)
  - Higher error rates (interference)
  - Higher delay variation (extensive error detection & correction mechanisms)
- Proprietary Solutions
  - ↳ Slow standardized procedure in heterogeneous environment
- Restrictions
  - ↳ To comply with national regulations
- Safety & security
  - ↳ Easy eavesdropping & interference with other equipments

* Design Goals

- Global operation
- Low power
- License-free operations
- Robust transmission technology
- Simplified spontaneous cooperation
- Easy to use
- Protection of investment
- Safety & security
- Transparency for applications.

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* How WLAN devices communicate?
  - Infrared Light Transmission
  - Radio Transmission

* Infrared Light Transmission
  - Use diffuse light reflected or if line-of-sight (LOC) exists b/w sender & receiver
  - Senders :- LEDs or laser diodes.
  - Receivers:- Photodiodes
  - Date rate:- 115 kbit/s to 4 Mbit/s

Disadvantages
- Low bandwidth
- Easily shielded
- LoS is needed for good quality

Advantages
- Simple & cheap devices
- Electrical devices don't interfere.

* Radio Wave Transmission
  - Used by almost all networks
  - Types :- AM(Amplitude Modulation) & FM(Frequency Modulation)

Advantages
- Widely used (radio transmissions for WAN & cellular phones)
- Cover large areas & penetrate objects.
- Do not need LoS if frequencies aren't too high.

Disadvantages
- Shielding is difficult
- Permitted in certain frequency bands
- Limited range of license-free bands

Chitra

"All the work you do, is done for your own salvation, is done for your own benefit." —Swami Vivekananda

Date __/__/____

Wireless Network

- A network setup by using radio signal frequency to communicate among computers & other network devices.
- Components
  - Wireless Router / Access point
  - Wireless clients
- Coverage provided by access points ⇒ coverage cells.

Operating Modes

Specified by IEEE_802.11 standards

① **Infrastructure mode**

Used to connect computers with wireless network adapters/clients to an existing wired network with help from access points.

② **Ad hoc mode**

- Used to connect clients directly ~~together~~, without the need for a router
- Consist upto 9 wireless clients, sending data directly to each other.

* 802.11 Architecture

- Wifi- technology
- Services :- a). BSS (Basic Service Set)
  b). ESS (Extended Service Set)

Components of structure

① Station (STA) ② Access Point (AP)

③ BSS :- STA & AP with same radio coverage form a BSS

④ Distribution system :- Interconnection network to form a logical network based on several BSS.

⑤ ↳ ESS :- Combination of BSS connected via distribution system through APs

⑥ Portal :- Bridge to other wired networks

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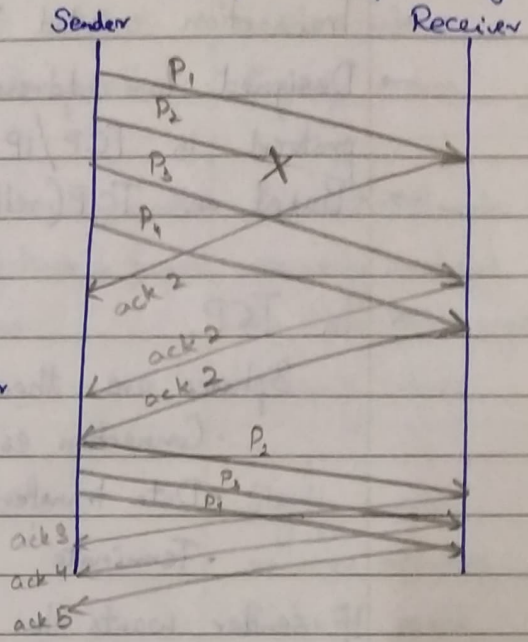
* SELECTIVE RETRANSMISSION

① Go-back N

- Consider 4 packets transmitted, in which P_2 gets lost. After P_1, the receiver was expecting P_2 but instead receives P_3 & P_4 which it discards. It sends "ack 2", i.e., the packet number expected.
- Sender again sends P_2 & along with it all the packets following in the order.



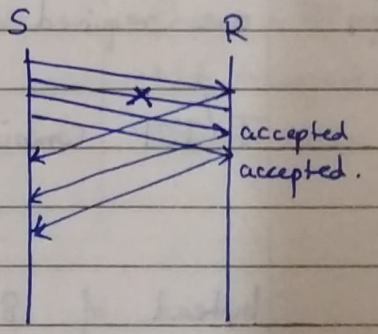
* **Disadvantage**
  - Loss/Wastage of bandwidth (only P_2 was lost, rest were received)

* TCP ack is cumulative, i.e, it asks inorder receipt of packet upto a certain packet.
  Eg ⇒ If receiver has received P_1 & P_2 & P_3 correctly, then ask will be ack 4.

* If a single packet is lost, the sender retransmits everything starting from the lost.

⇓

- TCP can indirectly request a selective retransmission of packet
  → Acknowledgement of only the lost packet



* **In selective retransmission, ack no. is important.**

↓

In Go-back N, ack is the no. of expected packet but in selective retransmission, ack no. defines the separate no. of single packet that is received safe & sound.

→ If packets are received out-of-order, in selective retransmission the receiver won't discard them & asks only for packet not received.

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Advantage: Only lost packets are retransmitted, hence low bandwidth required in a wireless link.

Disadvantage: More complex sequencing on receiver end, because more buffer is required for resequencing packets & to wait for gaps to be filled.

- Transaction oriented TCP (T/TCP)

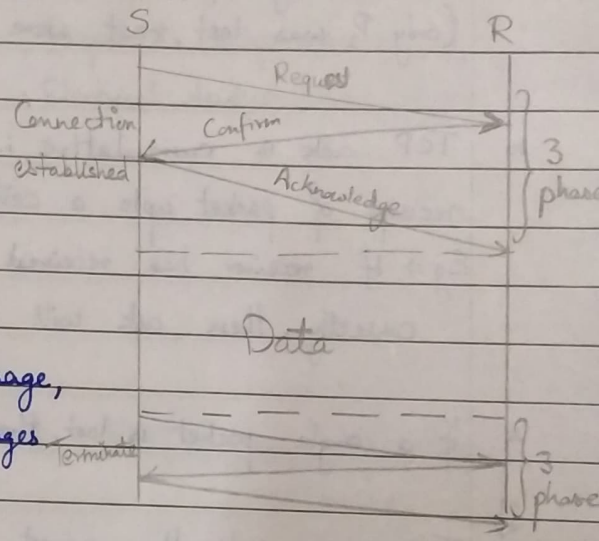
→ Designed to address the need for a transaction-based transport protocol in TCP/IP stack.

→ Based on TCP(reliable) & UDP(efficient) for transactions

* In TCP,

3 phases are there

- Connection establishment
- Data transfer
- Terminate



If sender wants to send only 1 message, then a total of 1+1+6 = 8 messages are required.

T/TCP combines packet for establishment + data + termination

Establish	Data	Terminate

Instead of 8, only 2 packets are used.

Advantages: Reduction in overhead than TCP

Disadvantages: Require changes in all corresponding nodes to function (initial only TCP)
Exhibit more security problems.

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Approach	Mechanism	Advantage	Disadvantage
Indirect-TCP	Splits TCP connection into two connections	• Isolation of wireless link • Simple	• Loss of TCP semantics • High latency at handover • Security issues
Snooping TCP	Snoops data & acknowledgements local retransmission	• Transparent end-to-end connection • MAC integration possible	• Insufficient isolation of wireless link • Security issues
M TCP	Splits TCP connection, chokes sender via window size	• Maintain end-to-end semantics • Handle long-term & frequent disconnections	• Bad isolation of wireless • Processing overhead due to bandwidth mngmt • Security issues
Selective retransmission	Retransmit only lost data	• Very efficient	• Slightly complex receiver software • ↑ buffer space.
T/TCP	Combines connection setup, release & data transmission	• Efficient for certain applications	• Changes in TCP required • Not transparent • Security issues.