SNS COLLEGE OF TECHNOLOGY

Coimbatore-35

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DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING

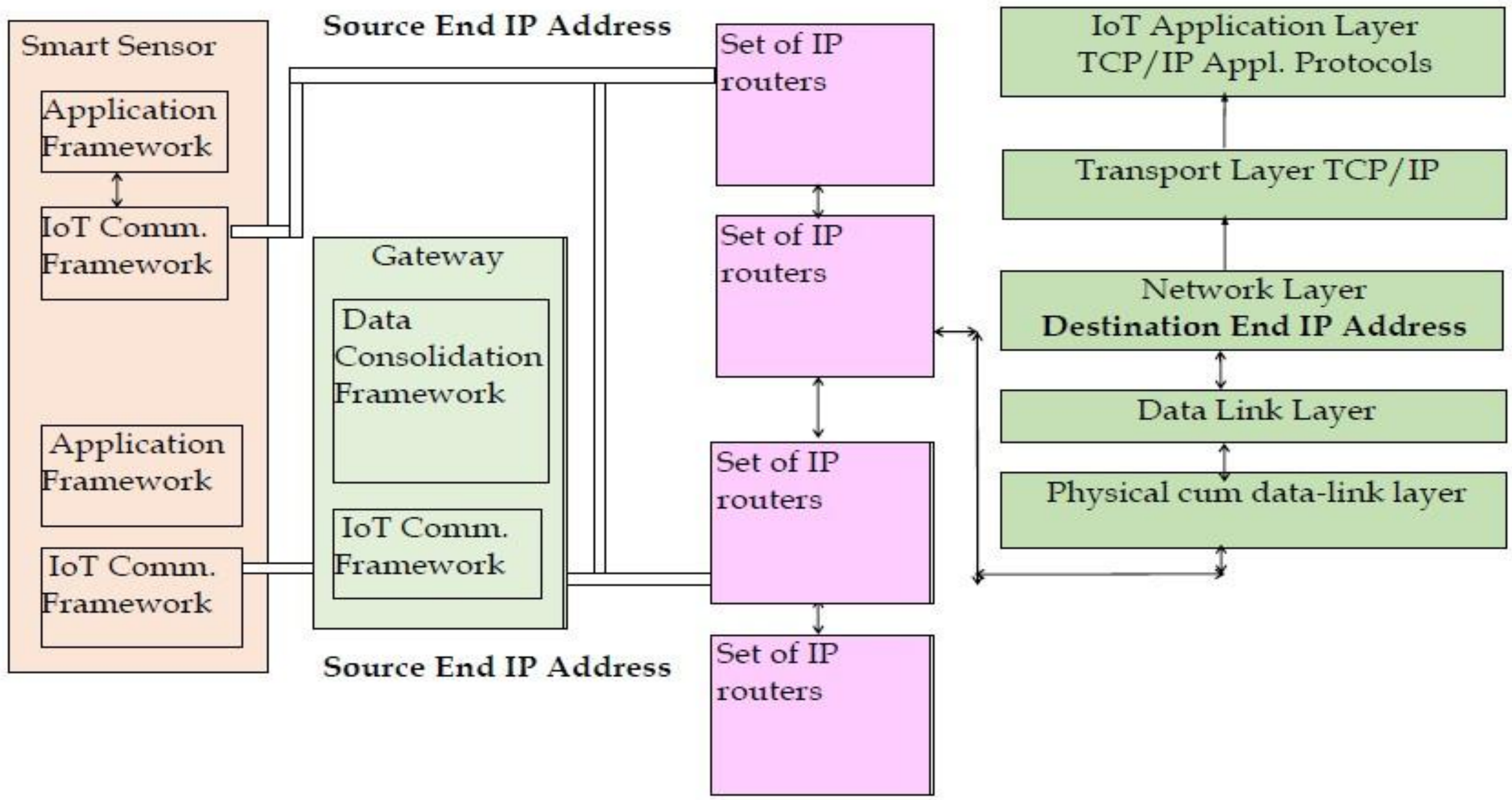
19ECE308- WIRELESS TECHNOLOGIES FOR IOT

III ECE / VI SEMESTER

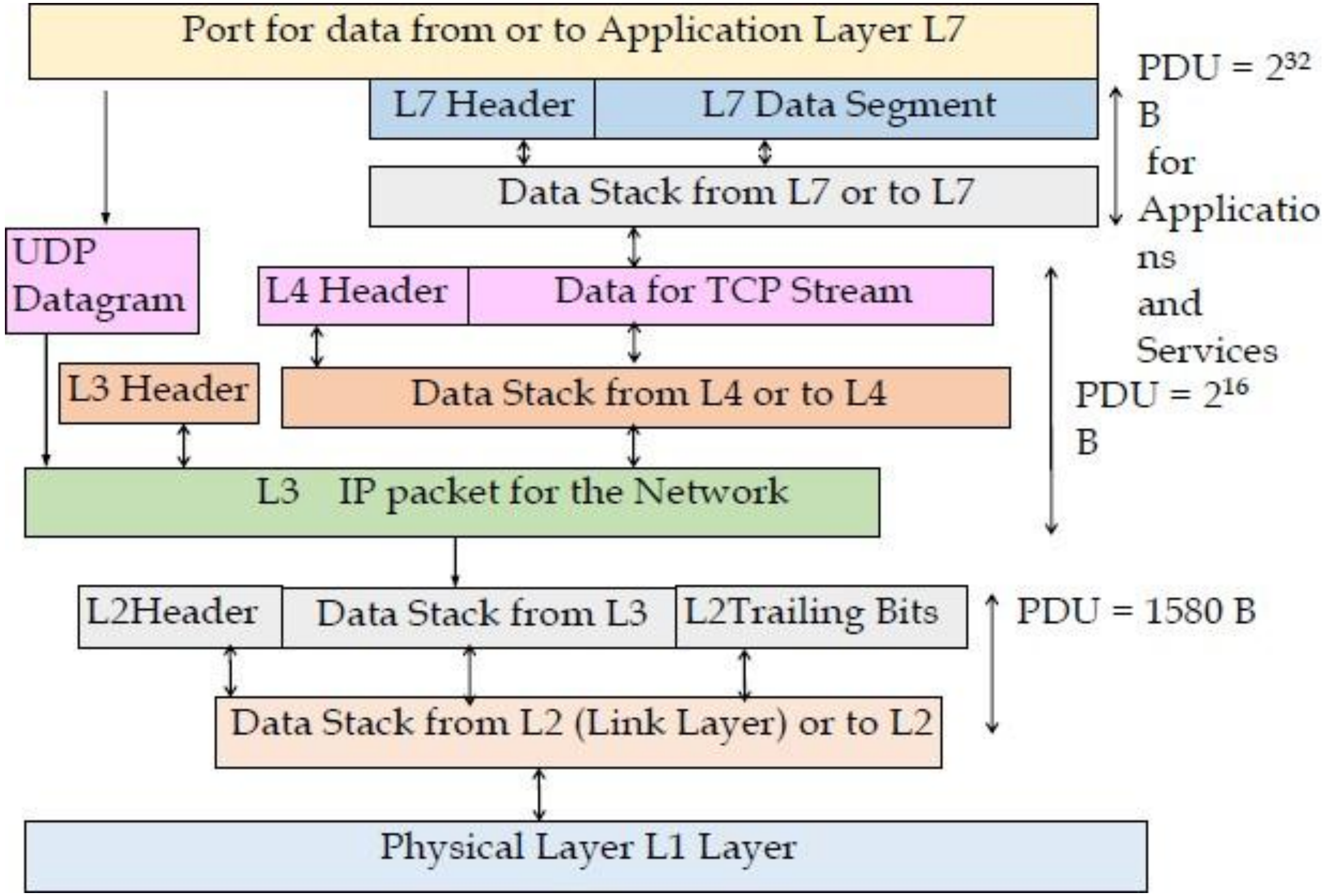
UNIT 2 – ARCHITECTURE AND DESIGN PRINCIPLES FOR IOT

TOPIC 6 –Application layer protocols: HTTP, HTTPS,FTP,TELNET and ports

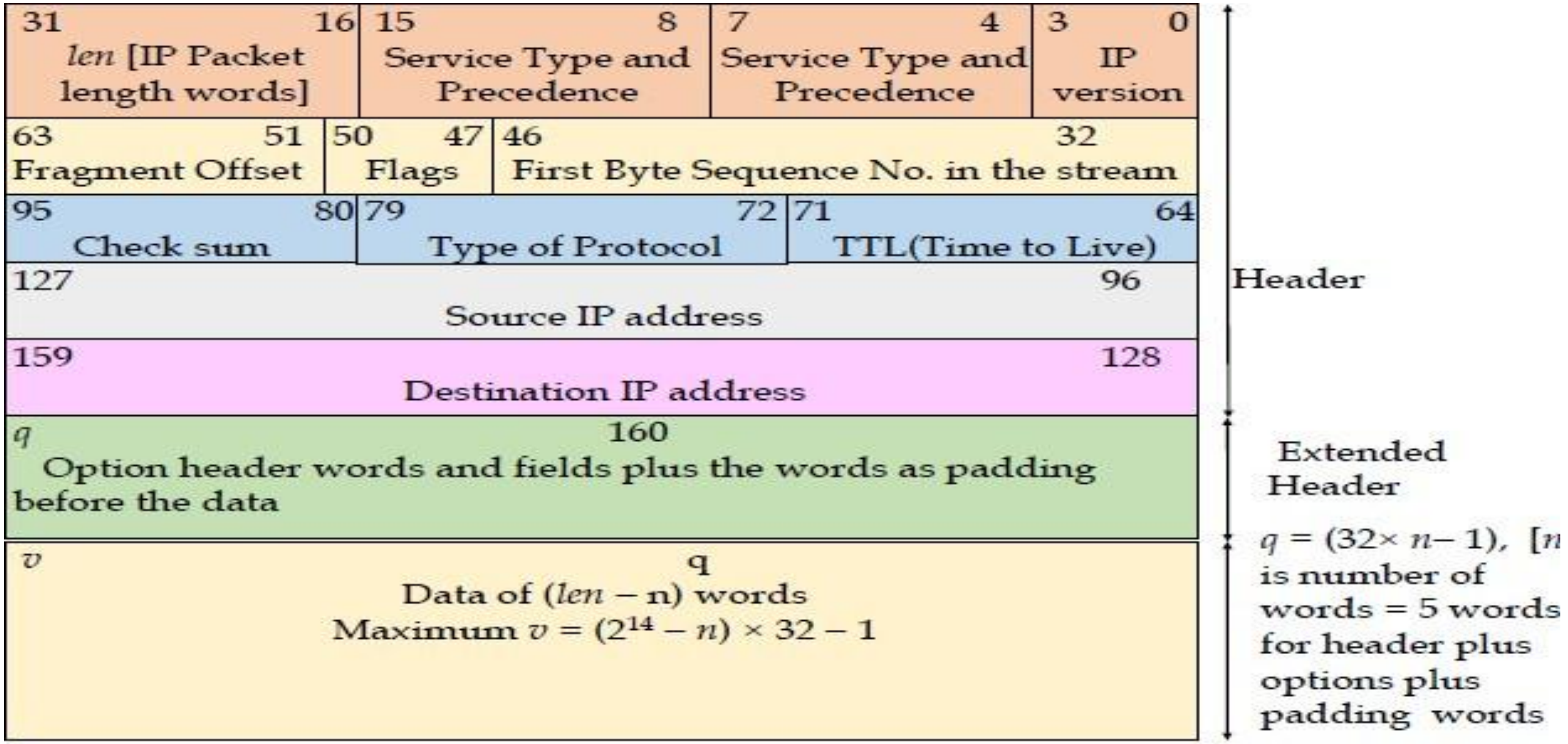
Source end network layer connected through set of IP routers for data packets from an IP address and communicating with IoT/M2M IoT Apps and Services layer using TCP/IP suite of Application protocols



TCI/IP suite four layers model generating data stack for the network, and for physical layer during Internet communication


Port for data from or to Application Layer L7
L7 Header
L7 Data Segment
Data Stack from L7 or to L7
PDU = 2^{32} B for Applications and Services
UDP Datagram
L4 Header
Data for TCP Stream
Data Stack from L4 or to L4
L3 Header
PDU = 2^{16} B
L3 IP packet for the Network
L2Header
Data Stack from L3
L2Trailing Bits
PDU = 1580 B
Data Stack from L2 (Link Layer) or to L2
Physical Layer L1 Layer

Data stack received or transmitted at or to transport layer, and packet consisting of IP header fields of 160 bits and extended header (n - 5) words (when required) plus data stack of maximum v words from or for the transport layer



31 16 *len* [IP Packet length words]

15 8 Service Type and Precedence

7 4 Service Type and Precedence

3 0 IP version

63 51 Fragment Offset

50 47 Flags

46 32 First Byte Sequence No. in the stream

95 80 Check sum

79 72 Type of Protocol

71 64 TTL(Time to Live)

127 96 Source IP address

159 128 Destination IP address

q 160 Option header words and fields plus the words as padding before the data

v q Data of (*len* – n) words Maximum $v = (2^{14} - n) \times 32 - 1$

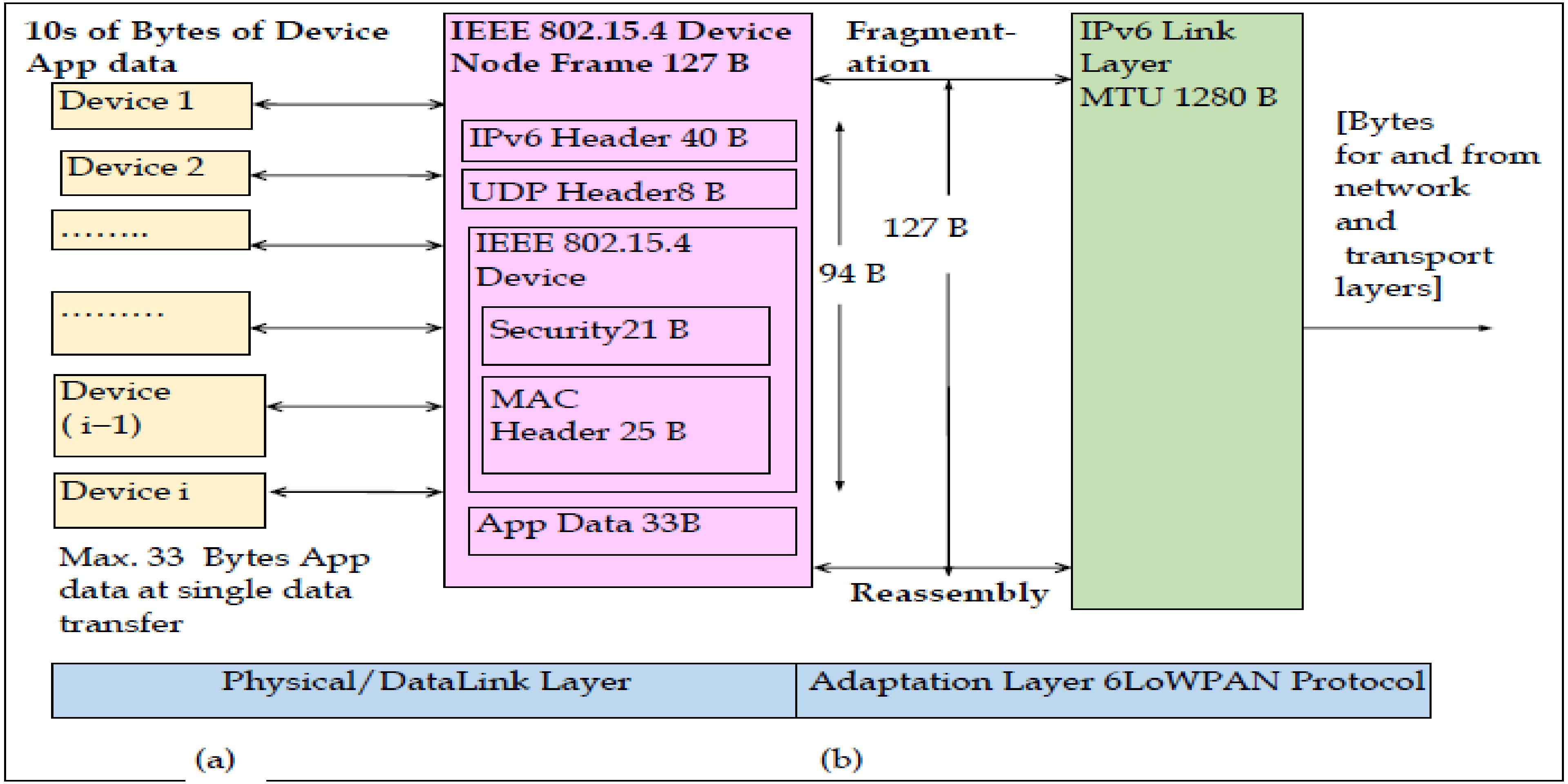
Header

Extended Header

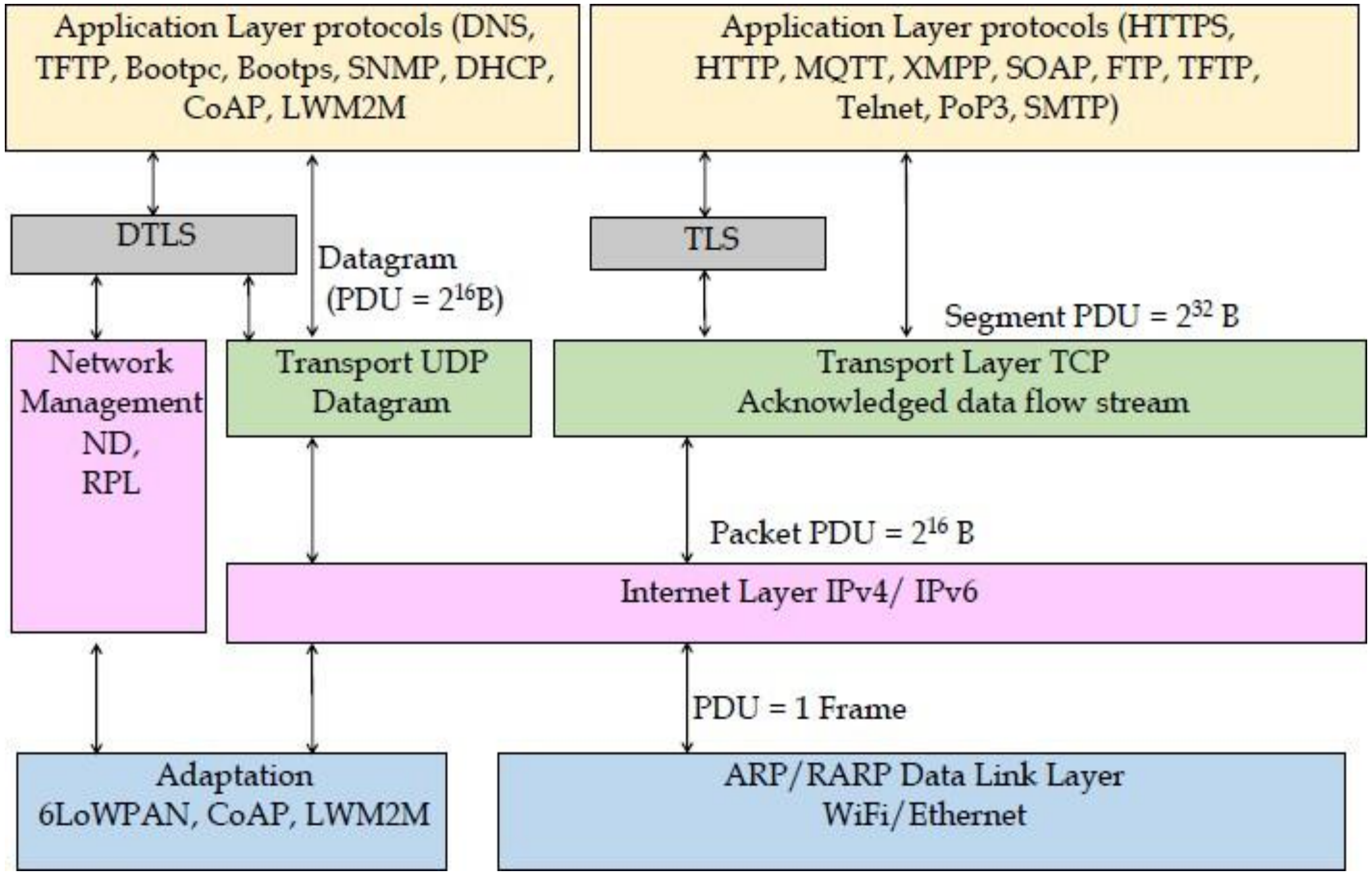
$q = (32 \times n - 1)$, [n is number of words = 5 words for header plus options plus padding words

Data Packet (stack) from or to Transport layer (Maximum Size $2^{14\text{ words}} = 2^{16}$ B

Physical layer IEEE 802.15.4 network devices (b) Adaptation layer 6LoWPAN protocol 127 B fragmented frames reassembly into IPv6 maximum 1280 B or fragmentation of IPv6 MTU 1280B into 127 B frames for transfer to a device.


10s of Bytes of Device App data
Device 1
Device 2
....
....
Device (i–1)
Device i
Max. 33 Bytes App data at single data transfer
IEEE 802.15.4 Device Node Frame 127 B
IPv6 Header 40 B
UDP Header8 B
IEEE 802.15.4 Device
Security21 B
MAC Header 25 B
App Data 33B
Fragment-ation
127 B
94 B
Reassembly
IPv6 Link Layer MTU 1280 B
[Bytes for and from network and transport layers]
Physical/DataLink Layer
Adaptation Layer 6LoWPAN Protocol
(a)
(b)

IoT TCP/IP Suite of Protocols for Internet



Application Layer protocols (DNS, TFTP, Bootpc, Bootps, SNMP, DHCP, CoAP, LWM2M

Application Layer protocols (HTTPS, HTTP, MQTT, XMPP, SOAP, FTP, TFTP, Telnet, PoP3, SMTP)

DTLS

Datagram (PDU = 2^{16}B)

TLS

Segment PDU = 2^{32} B

Network Management ND, RPL

Transport UDP Datagram

Transport Layer TCP Acknowledged data flow stream

Packet PDU = 2^{16} B

Internet Layer IPv4/ IPv6

PDU = 1 Frame

Adaptation 6LoWPAN, CoAP, LWM2M

ARP/RARP Data Link Layer WiFi/Ethernet

TCP/IP suite number of Application layer protocols

- Sent from specified port at transmission end and to the specified port at the receiver end, else receiver port does not listen
- HTTP, HTTPS, FTP, Telnet and Others
- A concept of Port: Each port uses a distinct protocol at an Application layer
- A port uses a protocol for sending and receiving messages.

Application layer HTTP Port

- **HTTP** (Hyper Text Transfer Protocol)
- Port number = 80
- HTTP port sends Application data stack at the output to the lower layer using the HTTP protocol
- An HTTP web server listens to port 80 only and responds to port 80 only
- Uses a URL for example http://www. mheducation.com/.
- Default port taken as 80 for the URL Port number can be specified after the TLD, for example, after .com in URL http://www. mheducation.com:80/.

HTTPS (HTTP over Secure Socket Layer or TLS)

- Port number = 443. An HTTPS port sends a URL, for example, https://en.wikipedia.org/wiki/List_of_TCP_and_UDP_port_numbers.
- Here, TLD is .org
- https://en.wikipedia.org/wiki/List_
- domain name is wikipedia.org.
- Sub domain name is en.
- Resource relative URL is /wiki/List_of_TCP_and_UDP_port_numbers

HTTP Client and Server

- HTTP standard protocol
- Requests a URL specified web page (resource)
- Web-Server sends in response the requested resource
- The HTTP client requests an HTTP server on the Internet
- The server responds by sending a response
- The response may be with or without processing

HTTP a Stateless Protocol

- An HTTP request assumed a fresh request as per the protocol
- No session or sequence number field or no field that is retained in the next exchange
- A current exchange by an HTTP request independent of the previous exchanges. The later exchanges do not depend on the current one.

Cookie

- A text file which creates during a particular pair of exchanges of HTTP request and response
- The creation is either at a CGI or processing program, for example, JavaScript or script or at a client.
- A prior exchange may then depend on this cookie
- An HTTP state management mechanism

HTTP Protocol Features

- Used more efficiently than the FTP
- On the other hand HTTP no command line overheads
- Very light (a small format)
- Speedy as compared to other protocols, such as FTP
- Able to transfer any type of data to a client provided it is capable of handling that data.
- Based on Object Oriented Programming System (OOPS)
- Eight HTTP specific specified methods 1. GET. 2. POST. 3. HEAD. 4. CONNECT. 5. PUT. 6. DELETE. 7. TRACE. 8. OPTIONS