Unit IV
Wireless Communication Protocols

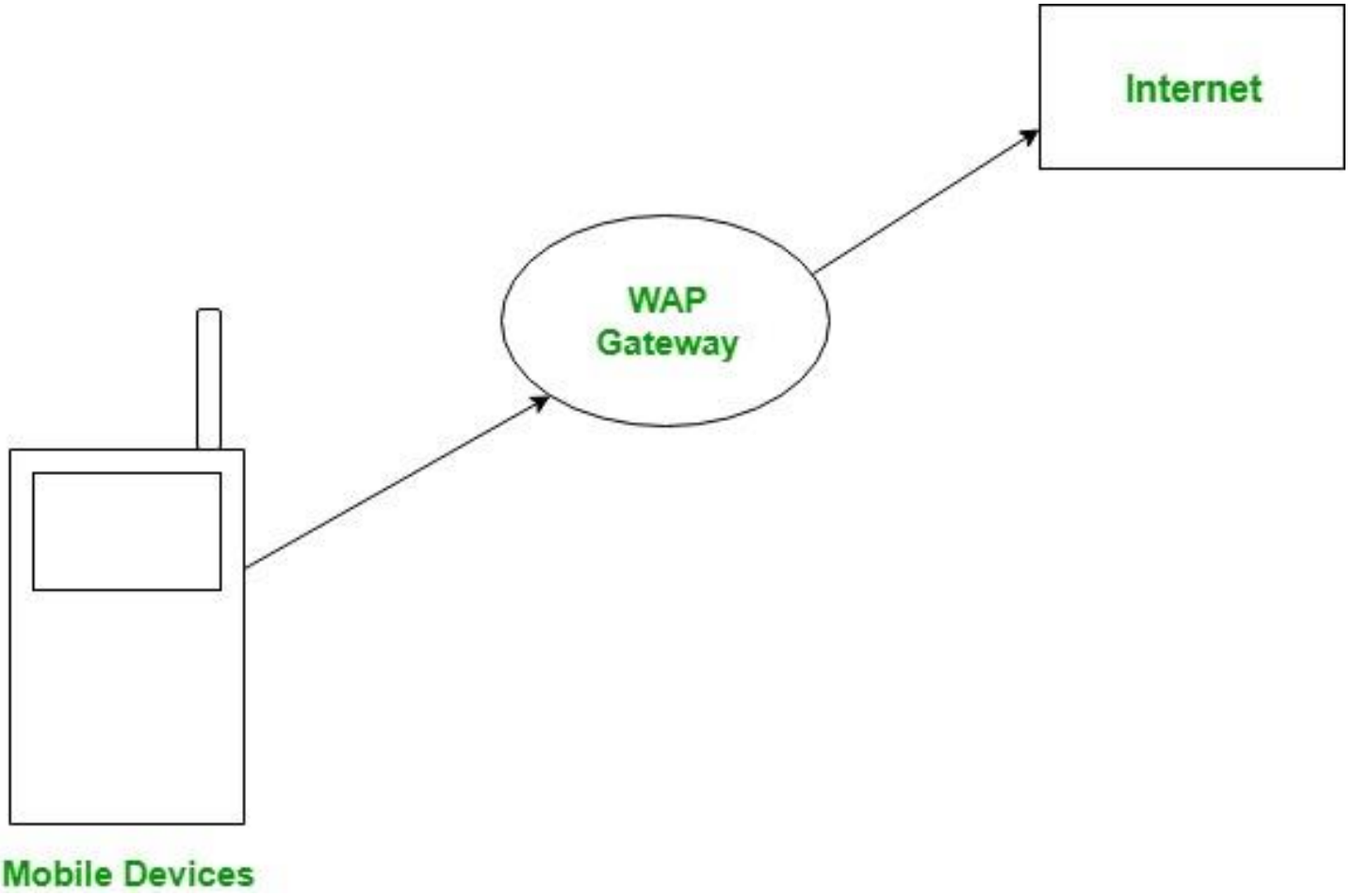
Contents

- Wireless Application Protocol
- The WAP Programming Model
- WAP Architecture
- Traditional WAP Networking Environment
- Wi-Fi Direct Li-Fi, NFC, SigFox, Z-Wave,
- LoRaWAN, Thread (based on IEEE 802.15.4),
- RT Wi-Fi, RTCP, RTSP, SPEED.

Introduction
Wireless Application Protocol

- The Wireless Application Protocol (WAP) is a set of communication protocols.
- An application programming model based on the World Wide Web (WWW).
- It is a protocol designed for **micro-browsers** and it **enables access to the internet** in **mobile devices.**
- It uses the markup language **WML** (Wireless Markup Language and **not HTML**) XML 1.0.
- WAP Forum was founded by Ericson, Motorola, Nokia and Unwired Planet whose aim was to standardize the various wireless technologies via protocols.

Open Mobile Alliance (OMA)



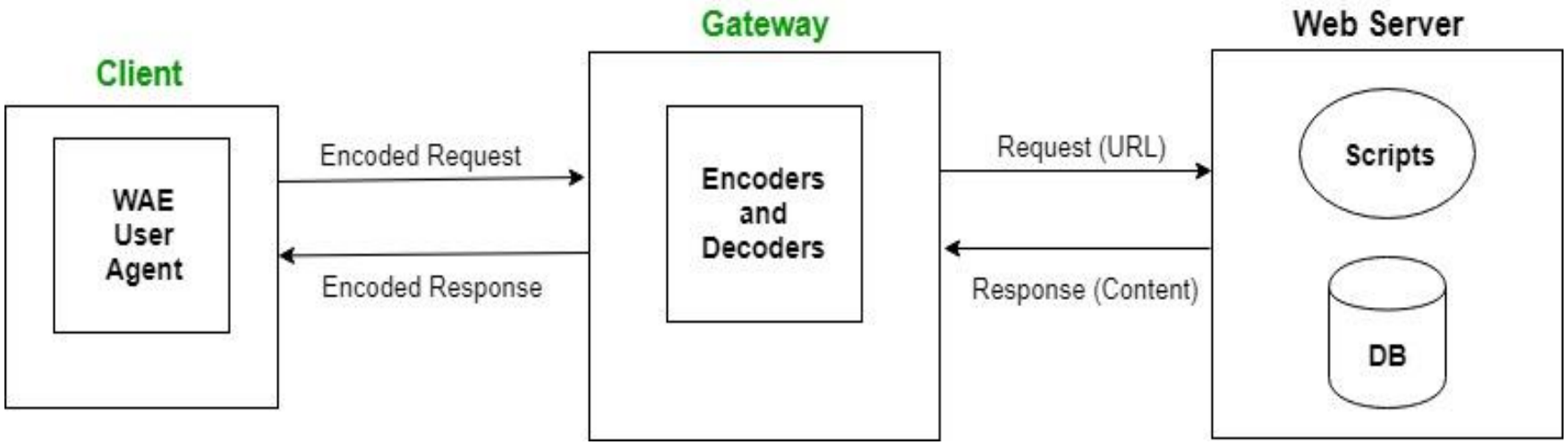
Why use WAP?

- **Wireless network and mobile phone operators.** WAP was designed to **improve existing wireless data services**, such as voicemail, while enabling the development of additional new mobile applications.

- **Content providers.** WAP **created a market for additional applications** and mobile phone functionalities for third-party application developers to exploit.
- **Writing applications in WML** was proposed as a new programming language for developers to create effective mobile device applications.

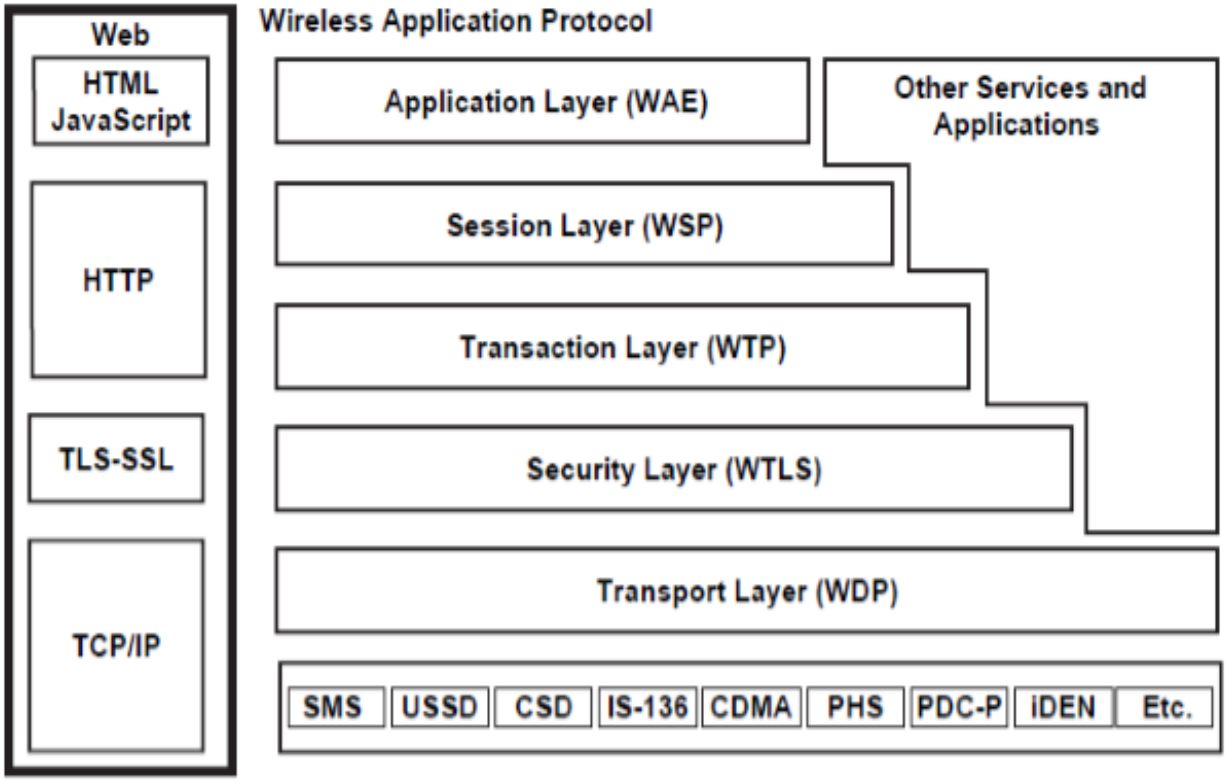
- **End users.** Mobile phone users would **benefit from easy, secure access to online services,** such as banking, entertainment, messaging and other information, on mobile devices.
- WAP could also allow access to intranet information -- such as corporate databases and business applications.

WAP Model



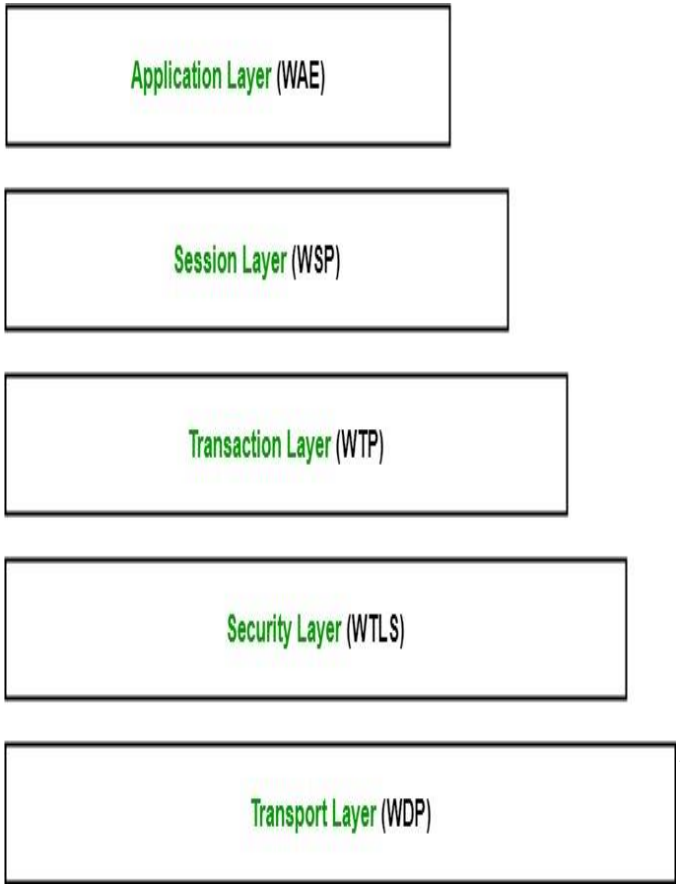
- The user opens the mini-browser in a mobile device.
- He selects a website that he wants to view.
- The mobile device sends the URL encoded request via network to a WAP gateway using WAP protocol.
- The WAP gateway translates this WAP request into a conventional HTTP URL request and sends it over the internet.
- The request reaches to a specified web server and it processes the request just as it would have processed any other request and sends the response back to the mobile device through WAP gateway in WML file which can be seen in the micro-browser.

WAP Architecture



- It provides a scalable and extensible environment for application development of mobile.

WAP Protocol stack



1. **Application Layer:** This layer contains the Wireless **Application Environment (WAE).** It contains mobile device specifications and content development programming languages like WML.
2. **Session Layer:** This layer contains **Wireless Session Protocol (WSP).** It provides fast connection suspension and reconnection.
3. **Transaction Layer:** This layer contains **Wireless Transaction Protocol (WTP**). It runs on top of UDP (User Datagram Protocol) and is a part of TCP/IP and offers transaction support.
4. **Security Layer:** This layer contains **Wireless Transport Layer Security (WTLS)**. It offers data integrity, privacy and authentication.
5. **Transport Layer:** This layer contains **Wireless Datagram Protocol**. It presents consistent data format to higher layers of WAP protocol stack.

Advantages of WAP

1. The main benefit brought about by WAP was that it made broad internet access possible for mobile devices.
2. WAP improved access speeds through data compression and helped reduce the number of timeouts and connection failures that had previously plagued mobile access.
3. Wireless Application Protocol is an open source that is totally free of cost.
4. You can send and receive real-time data with WAP.
5. WAP can be used over multiple platforms.

Disadvantages of WAP

- WAP connection speed is slow and number of connections are less.
- At some places it is very difficult to access the Internet, and also at some places it is totally impossible.
- Less secure.
- WAP provides a small User interface (UI).

WAP - Environment

- Wireless Application Environment (WAE), the uppermost layer in the WAP stack, provides an environment that enables a wide range of applications to be used on the wireless devices.

- **Components of WAE:**

- Addressing Model-WAP use the same addressing model as the one used on the Internet that is Uniform Resource Locators (URL).
- Wireless Markup Language (WML)-A lightweight markup language designed to meet a wireless environment with low bandwidth and small handheld devices.
- The Wireless Markup Language is WAP's analogy to HTML used on the WWW. WML is based on the Extensible Markup Language (XML).
- WML Script-A lightweight scripting language.
- Wireless Telephony Application (WTA, WTAI)-
- A framework and programming interface for telephony services.
- It create telephony services using WAP.

Hardware and Software Requirement

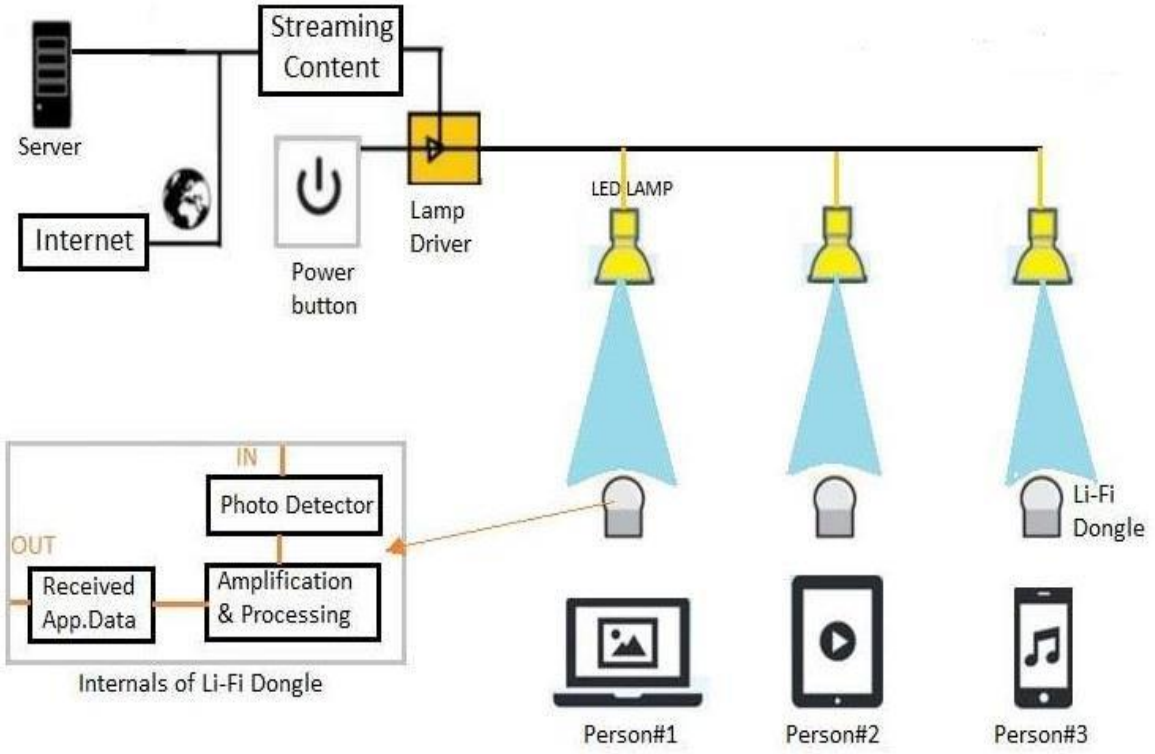
- Hardware and Software Requirement:
- At minimum developing WAP applications requires a web server and a WAP simulator.
- Microsoft IIS or Apache on Windows or Linux can be used as the web server and Nokia WAP Toolkit version 2.0 as the WinWAP simulator.

Wi-Fi Direct

- Wi-Fi Direct can transfer data at a rate 10 times faster than traditional Bluetooth on your android device.
- Wi-Fi Direct allows for direct device-to-device communication, bypassing your router or access point, even with no internet connection.
- Wi-Fi Direct (formerly Wi-Fi Peer-to-Peer) is a Wi-Fi standard for peer-to-peer wireless connections
- It allows two devices to establish a direct Wi-Fi connection without an intermediary wireless access point, router, or Internet connection.
- It is useful for everything from internet browsing to file transfer
- File sharing applications such as SHAREit on Android and BlackBerry 10 devices could use Wi-Fi Direct,

Li-Fi

- Li-Fi is a wireless communication technology which utilizes light to transmit data and position between devices
- Li-Fi is more secure than Wi-Fi
- **Faster**
- **Cheaper**
- **Secure**
- **More bandwidth**
- **Wireless and invisible**

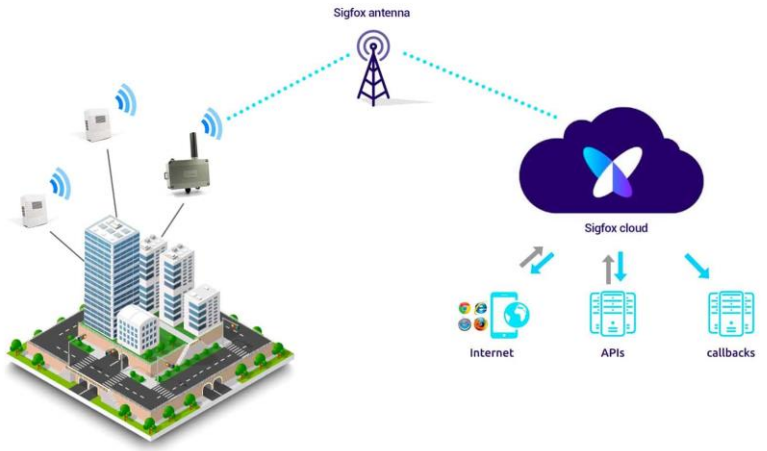


NFC

- Near Field Communication (NFC) is a set of short-range wireless technologies
- Typically requiring a distance of 4cm or less to initiate a connection.
- NFC allows you to share small payloads of data between an NFC tag and an Android-powered device, or between two Android-powered devices.
- NFC standards cover communications protocols and data exchange formats and are based on existing radio-frequency identification (RFID) standards

SigFox

- SigFox is a cellular style, long range, low power, low data rate form of wireless communications that has been developed to provide wireless connectivity for devices like remote sensors, actuators and other M2M and IoT devices.
- Sigfox is an inexpensive, reliable, low-power solution to connect sensors and devices.
- The range of Sigfox devices is up 40 km outdoors, and 10 km in urban areas.



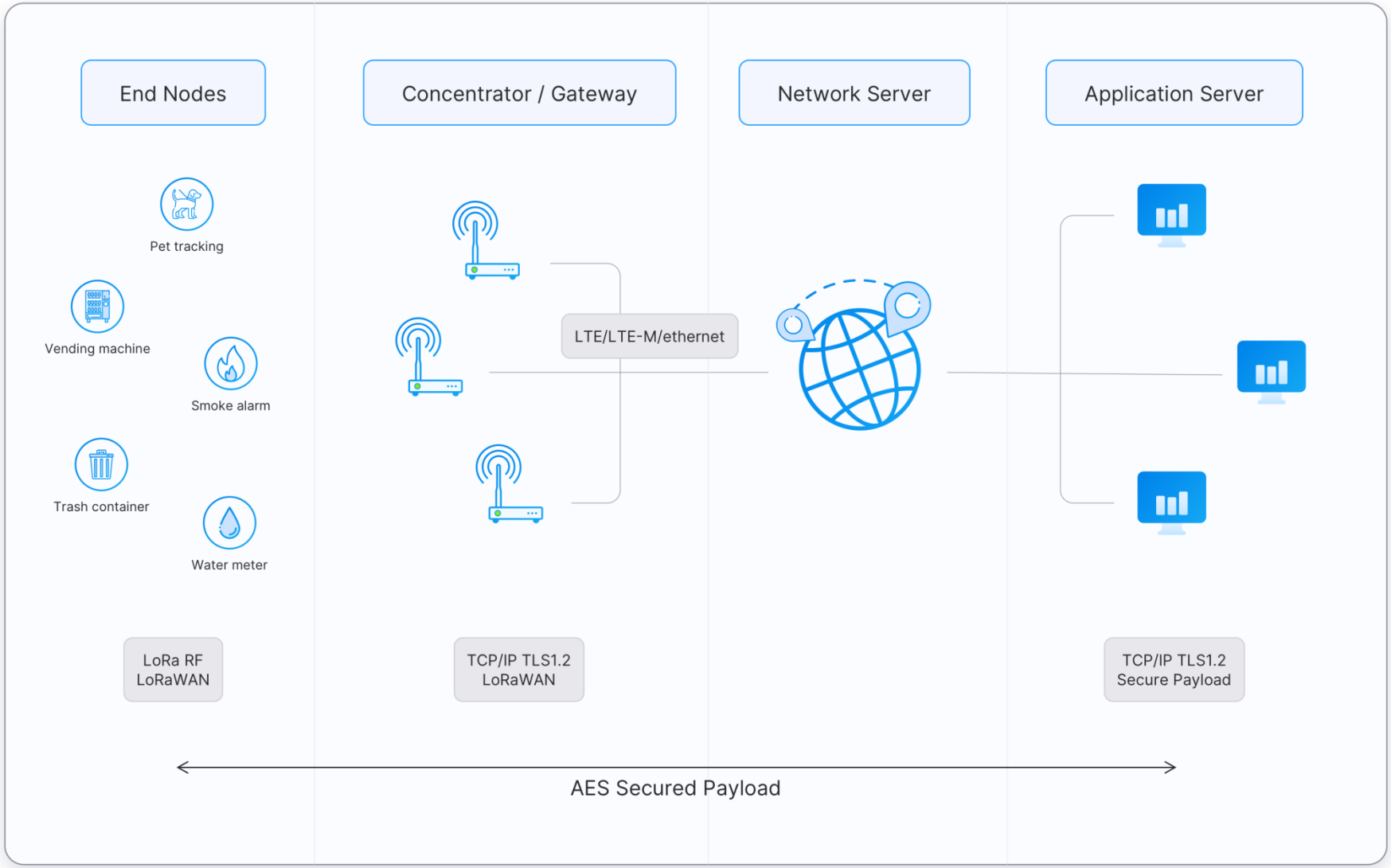
Z-Wave

- Z-Wave is a wireless communication protocol used primarily in smart home networks
- allowing smart devices to connect and exchange control commands and data with each other.
- Z-Wave protocol helps alleviate power issues and brings low-cost wireless connectivity to home automation, offering a lower-power alternative to Wi-Fi and a longer-range alternative to Bluetooth.
- his wireless protocol allows multiple wireless devices to communicate with each other in an affordable and reliable way with easy-to-use smart products.
- Z-wave maintains confidentiality and integrity, as it uses an encryption algorithm i.e. AES Algorithm that encrypts the incoming and outgoing messages.
- it consumes lower power than other wireless protocols

Z-Wave Working

- The device or node needs to communicate with another node at the end and if it is not directly reachable then it communicates with the other nearest node, this nearest node passes the message to the next node and that will send the message to the destination and vice versa.
- The nodes are added to the mesh network by some method and can be removed using the same method.

LoRaWAN Architecture



LoRaWAN Architecture

- **End Devices** - sensors or actuators send LoRa modulated wireless messages to the gateways or receive messages wirelessly back from the gateways. .
- **Gateways** - receive messages from end devices and forward them to the Network Server.
- **Network Server** - a piece of software running on a server that manages the entire network.
- **Application servers** - a piece of software running on a server that is responsible for securely processing application data.
- **Join Server** - a piece of software running on a server that processes join-request messages sent by end devices (The Join Server is not shown in the above figure).

Thread (based on IEEE 802.15.4)

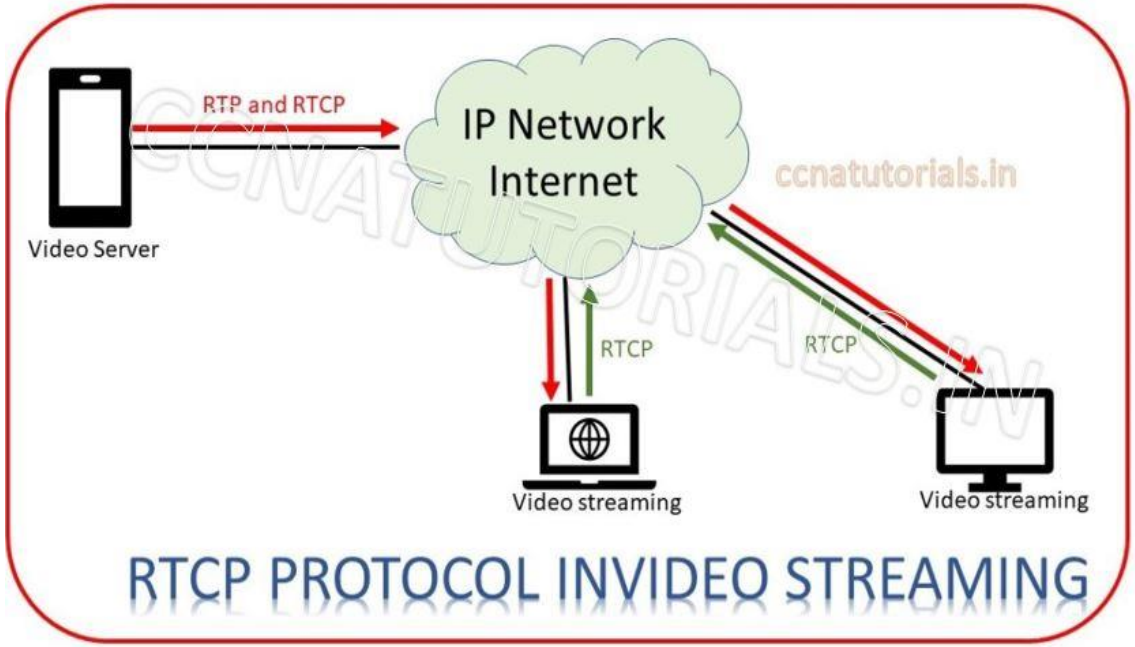
- Thread® is an IPv6-based networking protocol designed for low-power Internet of Things devices in an IEEE 802.15. 4-2006 wireless mesh network,
- **Thread's primary features include:**
- **Simplicity** — Simple installation, start up, and operation
- **Security** — All devices in a Thread network are authenticated and all communications are encrypted
- **Reliability** — Self-healing mesh networking, with no single point of failure, and spread-spectrum techniques to provide immunity to interference
- **Efficiency** — Low-power Thread devices can sleep and operate on battery power for years
- **Scalability** — Thread networks can scale up to hundreds of devices

RT Wi-Fi

- Real-Time High-Speed Communication Protocol
- It provide deterministic timing guarantee on packet delivery and high sampling rate up to 6kHz.

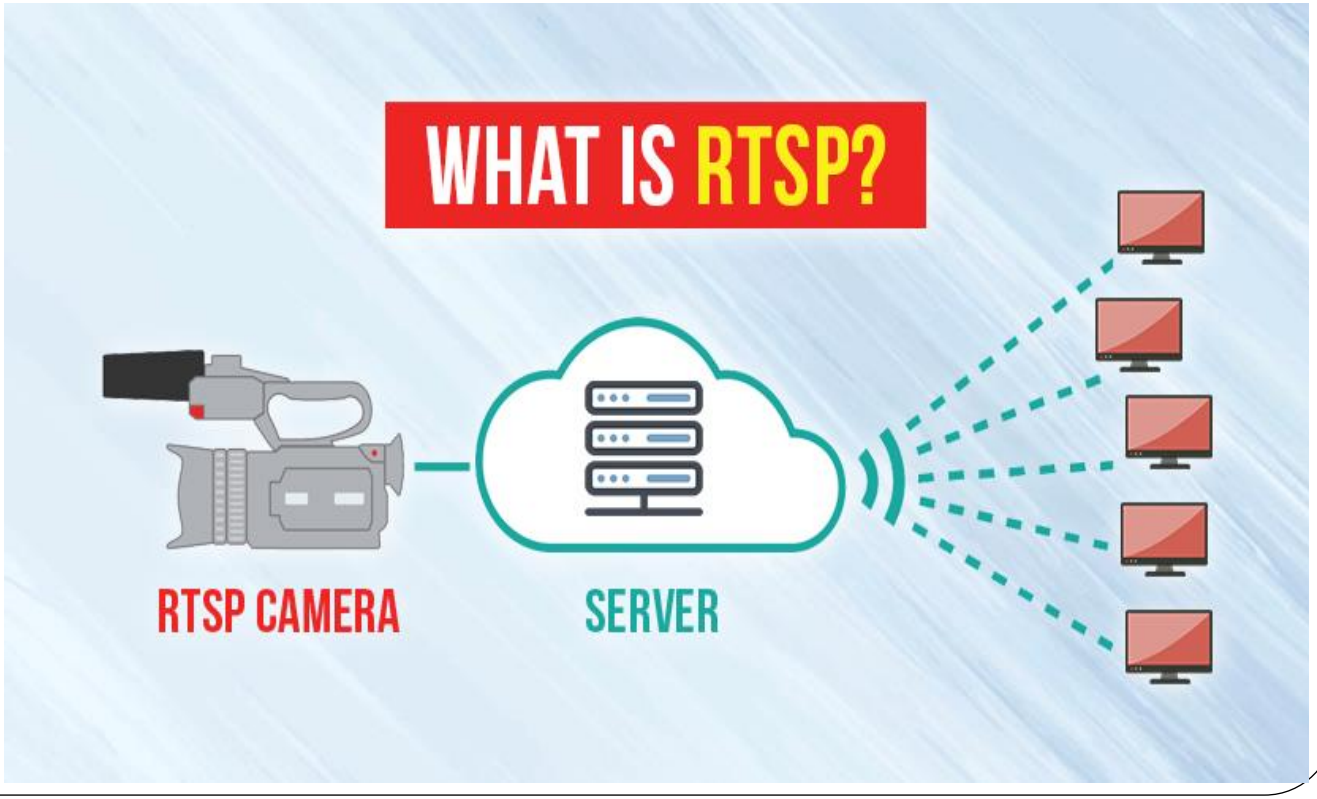
RTCP

- RTCP, or Real-Time Transport Control Protocol, is a network protocol that works with the Real-Time Transport Protocol (RTP) to monitor and control the delivery of multimedia content over IP networks.
- RTP carries the **media streams**, while RTCP is used to **monitor transmission statistics** and quality of service (see QoS)



RTSP

- RTSP, or Real-Time Streaming Protocol, is a network protocol that controls the delivery of real-time media streams, such as audio and video.
- It's used in a variety of applications, including: Streaming media over the internet, IP surveillance cameras, and Other systems that require real-time streaming content



ThankYou