CHAPTER -3

Architecture of WiMAX

3.1 Architecture:

The IEEE 802.16e-2005 standard provides the air interface for WiMAX but does not define the full end-to-end WiMAX network. The WiMAX Forum's Network Working Group (NWG) is responsible for developing the end-to-end network requirements, architecture, and protocols for WiMAX, using IEEE 802.16e-2005 as the air interface.

The WiMAX NWG has developed a network reference model to serve as an architecture framework for WiMAX deployments and to ensure interoperability among various WiMAX equipment and operators.
Below is simplified illustration of IP-based WiMAX network architecture. The overall network may be logically divided into three parts:

- Mobile Stations (MS) used by the end user to access the network.
- The access service network (ASN), which comprises one or more base stations and one or more ASN gateways that form the radio access network at the edge.
- Connectivity service network (CSN), which provides IP connectivity and all the IP core network functions.

The network reference model developed by the WiMAX Forum NWG defines a number of functional entities and interfaces between those entities. Fig below shows some of the more important functional entities.

Base station (BS): The BS is responsible for providing the air interface to the MS. Additional functions that may be part of the BS are micromobility management functions, such as handoff triggering and tunnel establishment, radio resource management, QoS policy enforcement, traffic classification, DHCP (Dynamic Host Control Protocol) proxy, key management, session management, and multicast group management.

WiMAX Mobility Subscriber Station: On the far left figure, mobile subscribers (MS) use mobile subscriber stations (MSS) generalized mobile equipment that provides connectivity between subscriber equipment and base station equipment.

Access service network gateway (ASN-GW): The ASN gateway typically acts as a layer 2 traffic aggregation points within an ASN. Additional functions that may be part of the ASN gateway include intra-ASN location management and paging, radio resource management and admission control, caching of subscriber profiles and encryption keys, AAA client functionality, establishment and management of mobility tunnel with base stations, QoS and policy enforcement, and foreign agent functionality for mobile IP, and routing to the selected CSN.

Connectivity service network (CSN): The CSN provides connectivity to the Internet, ASP, other public networks, and corporate networks. The CSN is owned by the NSP and includes AAA servers that support authentication for the devices, users, and specific services. The CSN also provides per user policy management of QoS and security. The CSN is also responsible for IP address management, support for roaming between different NSPs, location management between ASNs, and mobility and roaming between ASNs.

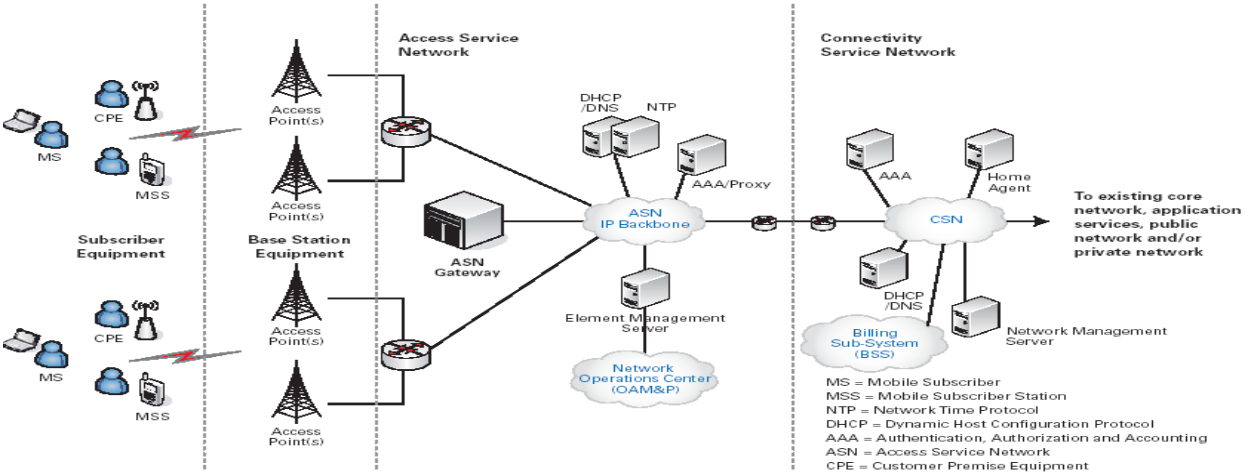

Fig: 3.1 IP-based WiMAX Architecture

The WiMAX architecture framework allows for the flexible decomposition and/or combination of functional entities when building the physical entities. The ASN may be decomposed into base station transceivers (BST), base station controllers (BSC), and an ASNGW analogous to the GSM model of BTS, BSC, and Serving GPRS Support Node (SGSN).

WiMAX is a technology based on the IEEE 802.16 specifications to enable the delivery of last-mile wireless broadband access as an alternative to cable and DSL.

3.2 The design of WiMAX network is based on the following major principles:

Spectrum: Able to be deployed in both licensed and unlicensed spectra.

Topology: Supports different Radio Access Network (RAN) topologies.

I**nterworking:** Independent RAN architecture to enable seamless integration and interworking with WiFi, 3GPP and 3GPP2 networks and existing IP operator core network.

IP connectivity: Supports a mix of IPv4 and IPv6 network interconnects in clients and application servers.

Mobility management: Possibility to extend the fixed access to mobility and broadband multimedia services delivery.

3.3 WiMAX Architecture depends on features:

WiMAX protocols and how they are designed to allow for point to point (PTP), point to multipoint (PMP) and mesh networks. Operators can use the mesh configuration to allow it to link base stations without the need to install or lease interconnecting communication lines. Some of the services WiMAX operators can provide include leased line, residential broadband, commercial broadband and digital television (IPTV) services.

WiMAX can use radio channel bandwidths that can vary from 1.25 MHz to 28 MHz and data transmission rates can exceed 155 Mbps. The types of data connections on WiMAX radio channels include basic (physical connection), primary (device control), and secondary (configuration) and transport (user data).

The typical range for WIMAX systems and how to extend the range of WIMAX systems through the use of directional antennas. Some of the most important topics of WiMAX Architecture featured include:

- The Functional parts of WiMAX systems
- Basic WiMAX Operation
- The types of WIMAX services
- Data transmission rates
- WIMAX industry standards
- WIMAX technology evolution

• Protocols used in WiMAX
• Physical and logical channel types
• The different types of WIMAX devices
• Basic security operation

3.4 WiMAX Architecture Security :

Since WiMAX utilizes IP (Internet Protocol) as its core transport mechanism for handing control/signaling, subscriber and management traffic, network service providers need to be concerned about the IP-related security treats and the implication security for end clients device, the core network, and application servers and everywhere in between.

The WiMAX standard includes specifications and guidelines for security enhancements in these areas:

1) The authentication of the subscriber device
2) Higher level (user) authentication
3) Advanced over -the-air data encryption
4) Options for securing control/signaling data within the core network, which all coverage on an IP-based, service oriented core backbone network.

Although security has been more stringently architected into WiMAX, due to the complexities involve in various deployment models of WiMAX networks, it is the responsibility of the network service providers to develop comprehensive security strategies for the design of secure network, policy, integration and operational security