

Security Sublayer: A Required Evolution of Wireless Security IEEE 802.16j

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Abstract—This paper investigates the fundamental and security issues of security sublayer reside at MAC layer of Wimax networks. Initially healthy overview of Wimax technology is documented followed by the weaknesses to the MAC layer and problems associated to the Wimax 802.16j. The risks and impacts are assessed according to a systematic approach. Several articles have been published to address the flaws in IEEE 802.16j Security even then enhanced version of this protocol cannot settle all the problems and additional flaws emerge. Here in particular vulnerabilities leading to the denial of service attacks on standard like regarding Reset-Command message, key sharing mechanism, water torture attacks, black hat threat etc are discussed in a precise and concise manner.

Keywords— Security Sublayer, Wimax, Dos Attacks, IEEE 802.16j, Authentication, Encryption

I. INTRODUCTION

In Wimax, The base station and subscriber station face most of the same security threats and attacks as their wired counterparts, including eavesdropping, masquerading session, hijacking, middle in man attacks, replay attacks etc. Moreover wireless network regardless of whether they belong to which family are inherently less secure than wired networks because they lack the physical infrastructure. [1]. Wireless networks represent an important example of such scenarios where capturing and forging packets are relatively easy. Attacks against networked systems are becoming more complex and powerful. IEEE 802.16j task group works on incorporating multihop relay capabilities into mobile Wimax, the change mode is highly agree with 802.16e mobile and subscriber stations, but a base station specific to 802.16j will be required for relays to operate. Standard launched a new product called Relay stations which is high cost efficient and less complex than base station with relay capabilities. RS is used to collect all traffics from different sources and relay it to a base station, there is no processing at relay station. As it's easy to install, cheaper and less complex nature, chances of introducing Rogue RS or hijacking of the session, or any sorts of attacks are much easier.

IEEE 802.16j security specifications can mainly be found within the MAC layer, security parameters within the MAC layer can be embedded in a separate layer called security sublayer. The goal is to provide access control and

confidentiality of the authentication, secure key exchange and encryption so when two parties establish a link, they are protected via a set of protocol that ensure confidentiality and unique access of the authorized parties. The unique hand shaking between the two entities, namely base stations and subscriber station is done at the MAC layer through security sublayer. [1]. MAC layer consists of three sub-layer, the first sub-layer is the service specific convergence sub-layer for mapping services to and from 802.16 Mac connections, the synchronous transfer mode (ATM) convergence layer is dedicated to ATM facilities whereas the packet convergence layer is accountable of for mapping conventions and protocols[2], the second sublayer is common part sub-layer which is the core of the standard and is tightly integrated with security sub-layer, the last sublayer is security sub-layer which lies between the MAC CPS and the PHY layer, addressing the authentication, key establishment and exchange etc between the MAC and PHY layer.[3]. This paper will address the security issues, vulnerabilities, threats and risks of IEEE 802.16j standard in a very precise and sequential manner.

II. SECURITY SUBLAYER THREATS AND SOLUTIONS

Most of the experts and professionals claiming that broadband data delivered over 3G cellular networks will choke the hope of the WiMAX industry for the standard to become worldwide significant. There are too many factors involved in weakening WiMax security, stability, Quality of service etc. A WiMax wireless access network consists of base stations and mobile stations (MSs). The base stations provide network add-on to the mobile stations. As a serving base station, a mobile station selects the one which offers the strongest signal. At this point, the subscriber plays the role of the user while a base station and a collection of served mobile stations play the role of system. In wimax most of the security issues are addressed and handled in the MAC security sub-layer as described in the figure below: After MAC common part sublayer, security sublayer starts, in common part sublayer MAC protocol data units (PDUs) are constructed, connections are established and bandwidth is managed, the common part exchanges MAC service data units (SDUs) with the convergence layer. The common part is tightly integrated with the security sublayer, the security sublayer addresses

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M Walker



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attention has been dedicated to them since the proposal appeared for their implementation in mobile cellular systems. Numerous researches conducted after that proposal have enabled incorporation of OFDM based relay systems in both accepted standards for IMT Advanced systems. Nowadays researches are ongoing with the aim to define new solutions for performance improvement of the standardized OFDM relay systems for cellular networks and one of the interesting solutions is implementation of subcarrier permutation SCP at the relay R station. The book *OFDM based relay systems for future wireless communications* presents a comprehensive research results in analyzing behavior and performance of the OFDM based relay systems with SCP. Dual hop relay scenario with three communication terminals and no direct link between the source S and the destination D has been analyzed as it is compliant with the accepted solutions for IMT Advanced systems. The book includes performance analysis and performance comparison of OFDM based amplify and forward AF relay systems with fixed gain FG amplify and forward AF relay systems with variable gain VG decode and forward DF relay systems each including two SCP schemes known to maximize the system capacity and or improve the bit error rate BER performances. Performance comparisons have enabled definition of optimal solutions for the future wireless communication systems in a given conditions and for the given optimality criteria. OFDM based relay systems for future wireless communications contains recent research results in this area and is ideal for the academic staff and master research students in area of mobile communication systems as well as for the personnel in communication industry.

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Adaptive PHY-MAC Design for Broadband Wireless Systems Ramjee Prasad, Suvra Sekhar Das, Muhammad Imadur Rahman, 2022-09-01. The next generation mobile communication networks 4G have the challenging target of providing a peak data rate of 1 Giga-bit per second in local area and 100 Mega-bit per second in wide area. The ability to offer such high data rates in 100 MHz bandwidth requires overall a very high spectral efficiency and hence the need for multi antenna techniques MIMO with spatial

multiplexing fast dynamic link adaptation and packet scheduling wideband access techniques and most likely non contention based spectrum sharing among multiple operators Many of these required technology components and techniques are well researched and established Adaptive PHY MAC Design for Broadband Wireless Systems explains how one can integrate and optimise their use in providing the target cell data rates with high availability The authors address the ability to cope with interference and enhanced physical layer processing and simultaneously the multifaceted system level design Focus is also on the selection of technology components and techniques which leads to the highest spectral efficiency and peak data rate availability with reasonable Quality of Service QoS support such as improved outage scenario reduced delay guaranteed bit rate etc In short this book will answer questions such as how individual techniques relate to each other how can we benefit the gains by suitable combinations of different technologies and how to choose different technological solutions in different scenarios etc The next generation mobile communication networks 4G have the challenging target of The next generation mobile communication networks 4G have the challenging target of providing a peak data rate of 1 Gigabit per second local area and 100 Megabit per second wide area *Radio Technologies and Concepts for IMT-Advanced* Martin Döttling, Werner Mohr, Afif Osseiran, 2009-10-01 Radio Technologies and Concepts for IMT Advanced presents the findings of the Wireless World Initiative New Radio WINNER project in Framework Program 6 of the European Commission It provides an insight into the key concepts and technologies for the IMT Advanced radio interface based on the collaborative research of manufacturers network operators research centres and universities within WINNER The book covers the fundamental radio characteristics of a typical 4G wireless communication system focusing on the transceiver s chain from the physical layer to layers 2 and 3 Starting by defining realistic and futuristic usage scenarios the authors provide in depth discussion of key technologies including modulation and coding link level procedures spatial temporal processing multiple access schemes and inter cell interference mitigation channel estimation and newly developed channel models Finally a cost assessment and optimisation methodology is developed for different deployment concepts in order to assess a wireless system in a condition close to reality The book provides an important system level approach to the latest radio technologies in the field and evaluates IMT Advanced research in relation to international standardisation Presents the research findings of IMT Advanced radio interface from the WINNER project Covers the latest concepts for relaying multiple access radio resource control flexible spectrum use and ITU R spectrum demand calculation Examines the most recent Multiple Input Multiple Output MIMO techniques and Distributed Antenna Systems Coordinated Multipoint Transmissions Describes a 4G system concept and all major building blocks Provides 4G propagation models and system level evaluation methodologies *Advances in Computational Intelligence and Its Applications* Sheikh Fahad Ahmad, Shadab Siddiqui, Rajib Debnath, Kakali Das, Figlu Mohanty, Sumit Hazra, 2024-06-07 It is with great pleasure and enthusiasm that we welcome you to the International Conference on Advances in Computational Intelligence and its Applications ICACIA 2023 In the ever evolving landscape of

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