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# Context and Dictionary based Hybrid Encoding Method for Optimizing WIMAX Communication

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**ABSTRACT**

WIMAX is worldwide interoperability for microwave access technology used for long distance wireless communication with higher data rates. It can be used as an alternative broadband. There is significant interest worldwide in the development of technologies for broadband wireless access systems. In this paper the performance of reliable packet marking in such network. Here proposing the probabilistic packet marking algorithm with the adding of four other approaches are used. First one is to decide the transmission path, Random packet marking approach. Second one for identification of visited route approach to trace back the path. Third one verification of transmitted data approach of combination of Context based and Dictionary based encoding techniques and fourth onechecksum will be applied to vary the alteration of data. The result will be more reliable transmission on WIMAX using the proposed system.

## 1. Introduction

WIMAX (Worldwide Interoperability for Microwave Access) is one of the most developing advances for Broadband Wireless Access (BWA) in metropolitan territories by giving an energizing expansion to the current broadband systems for the last-mile get to. It is exhibited that WIMAX is a suitable option in contrast to the link modem and DSL advancements because of its high asset usage, simple execution and minimal effort. Moreover, WIMAX not just improves the current highlights of the focused cabled access systems, yet furnishes high information rate applications with an assortment of Quality of Service (QoS) requirements. We are arriving at the objective of understanding an extraordinary remote system to cover a major territory. In an enormous scale remote system, the radio asset must be shared among numerous clients.

The data transmission allotment calculations have been intended for the productive use of the rare radio asset. What's more, to help sight and sound deals, the Medium Access Control (MAC) conventions will co-ordinate the transmission of traffic streams. The channel qualities of clients and traffic stream necessities are to a great extent different, inspiring us to plan a productive MAC layer conventions that can improve the framework execution due to the channel and traffic elements.

WIMAX operates on both licensed and non-licensed frequencies, providing a regulated environment and viable economic model for wireless carriers. The average cell ranges for most WIMAX networks will likely boast 4-5 mile range (in NLOS capable frequencies) even through tree cover and building walls. Service ranges up to 10 miles (16 Kilometers) are very likely in line of sight (LOS) applications (once again depending upon frequency). Mobile WIMAX capabilities on a per customer basis are much better than competing 3G technologies. WIMAX is often cited to possess a spectral efficiency of 5 bps/Hz, which is very good in comparison to other broadband wireless technologies, especially 3G.

The rapid development of Internet and wireless communication with high speed connection become a boon for the world. Today in the world of high speed communication and fast data transmission, wireless technology becoming a boon for everyone. Many companies are focusing on developing wireless access systems on the basis of various variables, like bandwidth, distance and power and broadly classified Wireless Technologies as “Wireless Personal Area Network (WPAN)”, “Wireless Local Area Network (WLAN)” and “Wireless Metropolitan Area Network (WMAN)”, “Wireless Broadband Access (WBA)” but they mostly lacking the common protocol platform. WIMAX is developed to change the situation and provide Interoperability to broadband wireless products. In recent time, Worldwide Interoperability for Microwave Access (WIMAX) become hottest broadband wireless technologies which is based on a “Broadband Wireless Access Metropolitan Area Network (BWA-MAN)”.It allows one to many point broadband wireless access. WIMAX is not a standard, rather it is trademarked by the WIMAX Forum which certify the interoperability of WIMAX components. 802.16's predecessors were not very accommodative of the European standards. WIMAX technology uses OFDM (Orthogonal Frequency Division Multiplex), MIMO (Multiple Input Multiple Output), adaptive modulation for providing the high speed data rates.

A framework for the context based encoding of an info sign incorporates a space change module and a context based coding module. The area change module is operable to change over the info signal into a succession of change coefficients c[i]. The context based coding module incorporates somewhat plane filtering module, and context demonstrating module, and a measurable encoding module. The bit-plane checking module is operable to create somewhat plane image bps [i,bp] for each change coefficient c[i] and each piece plane [bp]. The context demonstrating module is operable to appoint at least one context esteems to every one of the got bit plane images bps [i,bp]. The factual coding module is operable to code every one of the bit plane images bps [i,bp] as a component of at

least one of the comparing context esteems to deliver a context based encoded image stream

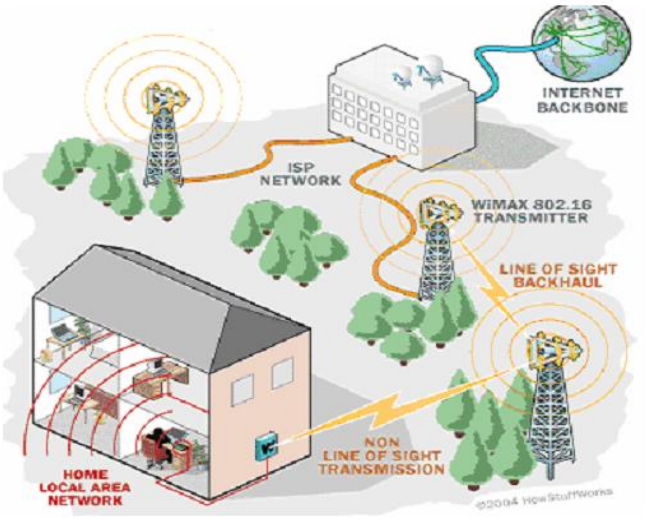


Figure1 OVERVIEW OF WIMAX TECHNOLOGY

**2. WIMAX Layered Protocol Architecture**

WIMAX network has primarily two topologies named as Point to Multi Point Base station for Subscriber station and Point to Point for backhaul. In this benchmark, multiple input multiple output antennas are utilized. IEEE 802.16 is Broadband wireless MAN protocol standard is mentioned below. WIMAX also provides numerous end user based applications and interfaces for examples ATM, IP, Ethernet, TDM, and VLAN.

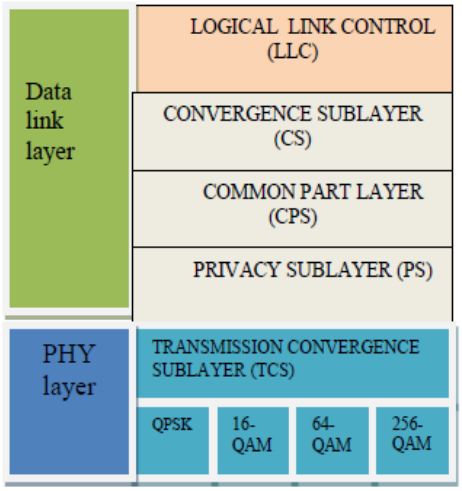


Figure 2 IEEE 802.16 Protocol layered architecture

To identify WIMAX protection troubles, we initial need to perceive WIMAX design and various characteristics of every components. In this section the background and various concerns regarding security and authorize exchange of data within the WIMAX network was discussed. IEEE 802.16 protocol architecture was designed as two layered architecture as:

1. Medium Access control (MAC) layer.
2. Physical (PHY) layer.

Logic link control is the communication protocol of OSI data link responsible for multiplexing and de-multiplexing protocols transmitted over MAC .PHY layer responsible for providing an electrical, mechanical, data transmission and reception. . It supports different digital modulation techniques like PSK, FSK, 16-QAM and 64-QAM". MAC sublayer is the responsible of determining which subscriber stations (SSs) have access to the network and is further divided in three more sublayers:

(1) Convergence Sublayer (CS): This layer maps data units of higher capacity into service units It allocate bandwidth and perform compress header part of data units. CS has two different services. ATM convergence sub layer and packet convergence sub layer. It suppresses the redundancy of headers at the sender side and restores those redundant headers at the receiver side.

(2) Common Part Sub-layer (CPS): This layer is personally integrated with the privacy sub-layer and responsible for establishing and maintaining the PMP (Point-to-multipoint) connection

(3) Privacy Sub-layer between the Common part sublayer of MAC and the PHY layer, dealing with the authentication, key swapping and cryptographic processing. It provides encryption and secure exchange of private key from the BS to SS.

 

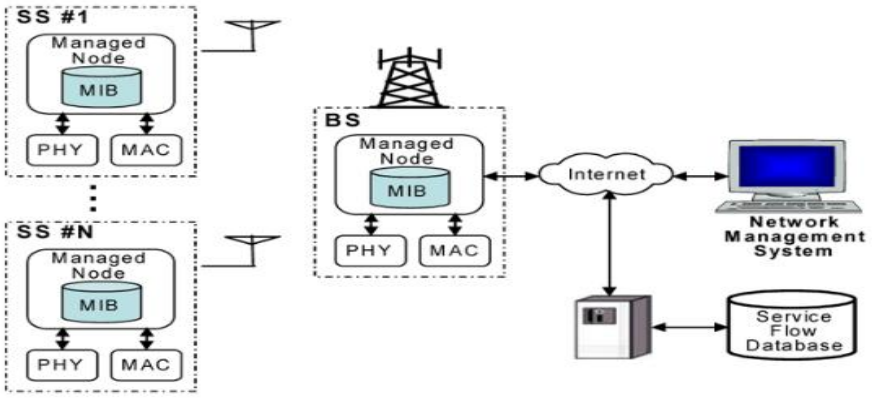


Figure 3 WIMAX Architecture

### 3. Dictionary Making Algorithm

Multiple sources files given as input to form a Dictionary.

1. Fetch the words from input files.
2. If a number is already present then increase this number by one else add this number and to the table and set the its occurrence to 1.
3. Arrange the table in descending order.
4. Assign the ASCII characters 33 to 250 to first 218 word of the table and then the remaining words.
5. Prepare a new table with words and code contained in it and store in dictionary 6. Stop.

### 4. Context-Based Coding

In this we encode by making some prediction by using some context based algorithm. So if the distribution or transformation is based on the history of sequence, it is predictive coding. We only work on history and we make some prediction for the sequence. There might not be need to send additional information to encoder and decoder. If we use that history to determine a sequence in a predictive manner, such scheme is known as predictive coding or context based coding. In this we only need to store that context that has occurred in the sequence being encoded. At the beginning of encoding we need to code letters that have not occurred previously in the context.

In this we utilize the restricted probabilistic replica to slant the allocation of the information the entropy employed the slanted allocation to instruct the novel information.

Utilize the conditional possibility to slant allocation unrestricted possibility:

P (‘h’) = 0.05, P(‘ u’) = 0.02.

**Conditional probability:**

P (‘h’ |‘t’) = 0.3, P (‘u’ | ‘q’) = 0.99.

**Practical issues:**

Can utilize lively or stationary facts? By means of higher-level context needs huge possibility table

**Solutions:**

Adaptive system

Using contexts of variable sizes

**Prediction with Partial Match**

Prediction with Partial Match (PPM) was proposed by Cleary and Witten in 1984. Instead of estimating these probabilities ahead of time, we estimate the probabilities as the coding proceeds Only need to store those contexts that have occurred in the sequence being encoded Need to code letters that have not occurred previously in this context ® using escape symbol.

**Example**

- Input sequence: probability
- Current symbol: a
- Check if P(a | prob) availble ® fourth-order context
- If yes, encode a, update P(a | prob)
- If not, send escape code, then check P(a | rob) ® third-order context
- . . . continue checking low-order contexts . . .
- If P(a | b) is not available, check P(a) ® zero-order context
- If ‘a’ has never happened before, use P(a) = 1/M, where M is the alphabet size, to encode a The equi-probable model is called ‘–1’ order context

### 5. Dictionary-Based Coding Techniques

The dictionary holds a list of strings of symbols and it may be static or dynamic (adaptive)

- Static dictionary – permanent, sometimes allowing the addition of strings but no deletions
- Dynamic dictionary – holding strings previously found in the input stream, allowing for additions and deletions of strings as new input symbols are being read

**Basic Idea of Dictionary Coding**

- Given an input source, we want to
- Identify frequent symbol patterns
- Encode those more efficiently
- Use a default (less efficient) encoding for the rest
- Hopefully, the average bits per symbol gets smaller
- In general, dictionary-based techniques works well for highly correlated data (e.g. Text), but less efficient for data with low correlation (e.g. i.i.d. Sources)

**Example**

- Consider an ‘English’ source with 26 letters & six punctuation marks
- Single-symbol FLC, fixed-length encoding: 5 bps
- Four-symbol FLC, fixed-length encoding: 20 bps (324)
- If we assume uneven distribution of the symbols

 

- Pick a dictionary which contains the 256 most-frequently
- Patterns (probability p) and encode them with 8 bits
- Encode the rest with 20 bits
- Use 1-bit prefix to distinguish the two cases
- Then, the average rate is 9p + 21 (1 – p) = 21 – 12p.
- If p > 0.084, 21 – 12p < 20.

**Static Dictionary**

- Using a static dictionary is less complex, but the probability p of a hit highly depends on the applications
- For student records at a university is probably ok.
- The key for success is that the most common patterns are a small subset of all possible messages
- Out of over 100,000 English words, only less than 2,000 words are used in most writings

**Digram Coding**

- The dictionary is composed of all letters from the alphabet
- As many digrams (pairs of letters) as possible
- For example, if we want to encode pure ASCII text documents, we can design a dictionary of size 256 entries, and Source alphabet: 95 printable ASCII symbols
- Digrams: 161 most common pairs

**Simple Digram Coding Example**

- The source alphabet A = {a, b, c, d, r}
- Dictionary:

| Code | Entry | Code | Entry |
|---|---|---|---|
| 000 | *a* | 100 | *r* |
| 001 | *b* | 101 | *ab* |
| 010 | *c* | 110 | *ac* |
| 011 | *d* | 111 | *ad* |

- Try to code the sequence abracadabra, the output is 101100110111101100000.

**6. Research Challenges**

Planning calculations fill in as a significant part in any correspondence arrange to fulfill the QoS necessities. The structure is particularly tested by the restricted limit and dynamic channel status that are natural in remote correspondence frameworks. To plan a MAC layer convention which can streamline the framework execution, the following highlights and criteria ought to be concerned.

**• Bandwidth use**

Effective transmission capacity usage is the most significant in the calculation structure. The calculation must use the channel effectively. This suggests the scheduler ought not dole out a transmission opening to an association with a right now awful connect.

**• QoS necessities**

The proposed calculation should bolster various applications to endeavor better QoS. To help delay-touchy applications, the calculation gives the postponement bound provisioning. The long haul throughput ought to be ensured for all associations when the adequate transfer speed is given.

**• Fairness**

The calculation should allocate accessible asset reasonably crosswise over associations. The decency ought to be accommodated both present moment and long haul.

**• Implementation unpredictability**

In a rapid system, the booking basic leadership procedure must be finished in all respects quickly, and the reconfiguration procedure in light of any system state variety. Consequently, the measure of time accessible to the scheduler is constrained. A low-unpredictability calculation is fundamental.

**• Scalability**

The calculation ought to work productively as the quantity of associations or clients sharing the channel increments.

**7. Time Taken For Encryption-Decryption Process**

We have performed 10 Simulations to get Time consumption in Encode-Decode process and to get accuracy of Process.

Table and figure shows the decoding time of the few Simulations which are encoded by proposed and existing approaches. It can be seen in the graph that binary data takes less time to decode.

**Table 1: Decoding time**

| Sr. No. | Input Data | Validation | Context technique Time (S) | Dictionary technique Time (S) | Hybrid (Proposed technique) Time (S) |
|---|---|---|---|---|---|
| 1 | 0100100011110 | Success | 0.0223685 | 0.0223683 | 0.0223682 |
| 2 | Hello I LIVE IN INDIA I am Phd scholar Engineering | Success | 0.175918 | 0.175917 | 0.175915 |
| 3 | WELCOME TO INDIA | Success | 0.087283 | 0.087283 | 0.087282 |
| 4 | 11101111 | Success | 0.0045889 | 0.0045888 | 0.0045887 |
| 5 | TESTING | Success | 0.069823 | 0.069823 | 0.069822 |
| 6 | hybrid technique | Success | 0.128476 | 0.128476 | 0.128475 |
| 7 | Signal | Success | 0.049350 | 0.049349 | 0.049347 |
| 8 | Engineering | Success | 0.052430 | 0.052429 | 0.052428 |

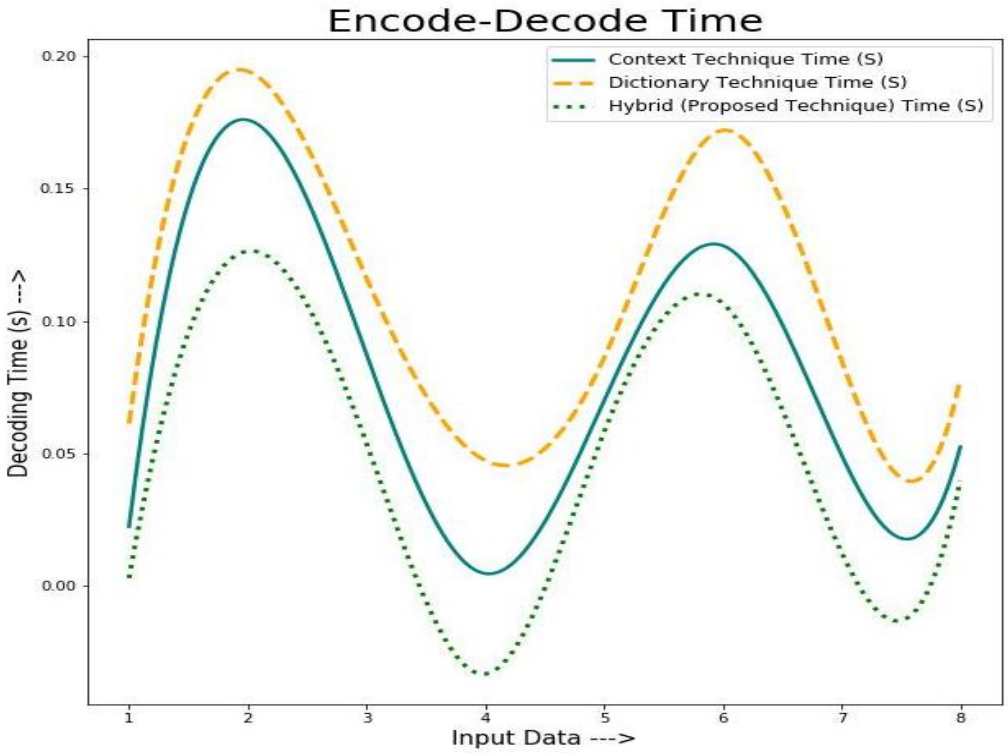


Figure 4: Encode-Decode time

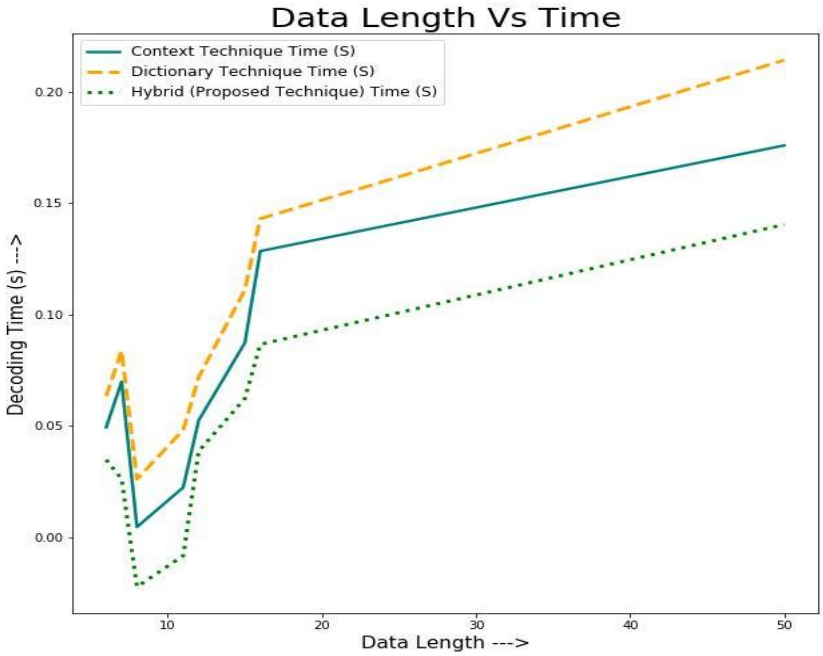


Figure 5: Length vs.time

As shown in figure 5 the decoding time increases as the length of the data increases, but the binary data takes lesser time to decode.

**8. Conclusion and Future Scope**

It is expected that WiMAX becomes the dominant standard for Wireless MAN networks in the world market, at least, in fixed broadband networks. A brief comparison between 802.16 and 802.16a has been provided and also it has been shown the advantage by using adaptive modulation. It has been explained that the key difference between the initial 802.16 standard and the 802.16a consists of the modulation scheme. The importance of OFDM has also been analyzed and this becomes an important feature that makes the difference between the 802.16 and 802.16a standard. More about this topic can be found in the literature provided. PHY and MAC layers of WiMAX have been Discussed Future possible applications have been discussed. WiMAX mobility standard is the next step. However, it will have its competition too with the 802.20 standard that in short is called Mobility-Fi. We will have to wait for the products and their performance in real environments in order to evaluate what the standard addresses

 

and the real performance of these products. There are already prototypes and also development kits using WiMAX standard that are used for education and mainly for research. Nowadays, there are also some products that have been introduced into the market that already contains the WiMAX standard presented here. Market is the key word to take into account. Products will have to be delivered according to the market needs and those for endusers will have to be extremely easy to install. Experience from DSL and cable modems services shows this drawback. Of course, in addition to be easy to install and provide good technical features, these products have to provide low-cost or at least a clear advantage over other technologies that are, at this moment, already matured in the market like xDSL and cable modem.

Communicating signals by using radio waves as the medium instead of wires is the method for utilized in remote. It has been offered an alternate way out for issues identified with the entrance the information. Today remote is extremely famous innovation that is offering shape to increasingly advantageous and practical world.

The projected way provides a trustworthy packet marking in wireless network which is based on Random packet marking approach with algorithm mentioned above. Also a combined approach of Context based and Dictionary based programming way implemented and executed to authenticate the communicated data along Checksum to check integrity for the information.

The primary goal of Packet Marking method is use IP address for routing path in the attack path and develops the attack path again to find out the source router of the intruder. Although it is not easy to deliver the IP address in a single packet, so the packet marking approach set length of marking node so that it can be easy to trace Node.

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