Video Streaming Analysis on Worldwide By Using wireless network(WIMAX 802.16d)

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Abstract:-

In the recent years, more and moreinformation services require high-speed data access. Videostreaming is a real-time service with high-speed dataaccess which conveys information such as audio and videonetworks using Internet Protocol (IP). Using the streamingtechnology clients can play the video in real timecondition. However, it's strongly influenced by thebandwidth. Insufficient bandwidth for the streamingprocess will cause losses and greater delay[1]. Therefore,in order the video streaming service to approach its idealconditions it is necessary to be applied on a network whichhas a high speed data access and large bandwidth.

Suchconditions can be fulfilled by the WiMAX network802.16d, because it is the network technology based oninternational standard IEEE 802.16 which enable totransfer data to wireless broadband access as analternative to cable or DSL. WiMAX can provide thefollowing types of access : fixed, portable andmobile wireless broadband on the line of sight (LOS) andnon-line of sight (NLOS) conditions[2]. Based oncalculations, by varying the distance 1 km - 15 km betweentransmitter and receiver for LOS and 1 km - 5 km forNLOS, the value of the propagation losses on NLOS isfound to be much larger than on LOS.

In LOS conditions,the value of bit error probability is smaller than the NLOSconditions for all types of modulation. The best conditionsoccur in LOS using QPSK modulation with 2.6 Mbps datarate with bit error probability 2.6184x10-45 and packetloss probability of video streaming is 9.12x10-4.

. INTRODUCTION

A. Fundamental Concept:- WiMAX (Worldwide Interoperability for Microwave Access) is a connection-oriented wide area network [3]. It supports high bandwidth and hundreds of users per channel at speeds similar to currently seen for DSL, Cable or a T1 connection; Promises to provide a range of 30 miles as an alternative to wired broadband like cable and DSL. It could potentially provide broadband access to remote places. Use point-to-multipoint (P2MP) architecture. It is designed for delivering broadband seamless quality multimedia services to the end users.

B. WiMAX Devices

•A WiMAX base-station which is similar to a cellular tower, except that it can cover of almost of 3,000 square miles(8,000)square km.

•A WiMAX receiver could be standalone tower or a PCMCIA card inserted into your laptop. By having such large coverage areas, potential problems of handoffs associated with 802.11 seems to be solved.

C. Challenge:- QoS is a challenge. Efficient scheduling design is left for designers and developers. Consequently providing QoS Scheduling Architecture for WiMAX Base Stations is a challenge for system developers.

D. WiMAX and Wireless Mesh Network

“If WiMAX and Wi-Fi technologies can work together in a mesh environment, it would bring at least a temporary resolution to the issue of whether or not the technologies are actually competitive with one another. Itseems that as the wireless newcomer,WiMAX networks are designed for supporting differentclasses of multimedia services that fulfills QoS requirements. This technology (WiMAX) is able totransmit video, voice and real time data. Fortransmitting multimedia services in WiMAX network itis desired to design some controlling mechanisms forsolving different problems in a network. Because ofcomplex nature of controlling mechanisms it is desiredto design intelligent controlling techniques.

WiMAX that stands for World Interoperability for Microwave Access, is a standard based on IEEE 802.16 broadband wireless access metropolitan area technology, and it is an air-interface standard for microwave and millimeter-wave band. WiMAX also known as IEEE Wireless Metropolitan Area Network, can provide an effective interoperability broadband wireless access method under the MAN of a point to multipoint multi-vendor environment. Wireless mesh networks are widely envisioned to be a key technology to improve the capacity and coverage for wireless broadband access services at reasonable costs in rural areas where wired communication infrastructure is too costly to install[4].

The current telecommunications technology has evolved to the needs of high-speed data access. Video streaming is a real-time service with high-speed data access which conveys information such as audio and video networks using Internet Protocol. Using thestreaming technology, in ideal conditions clients can play the video in real time. Ideal conditions of the video streaming is strongly in flounced by the bandwidth.Inadequate bandwidth in the process stream will cause
the loss and greater delay.
Therefore, in order thatservice streaming video applications approach idealconditions it needs to be applied on a network that has a high data access speed and wide bandwidth. Termsconditions can be met by the WiMAXis a basic standardized IEEE 802.16technology that allows transfer of data to access wireless broadband access as an alternative to cable or Digital Subscriber Line. WiMAX can provide access to the type of fixed, nomadic, portable and mobile wireless broadband to the condition of LOS and NLOS. Just with one Base Station, the theoretical coverage of the cell radius could reach 50 km. WiMAX also includes quality of services features that enable services such asvoice and video with low delay.

According to the WiMAX Forum, the system can transmit data at speeds up to 75 Mbps per carrier for the type of fixed and portable access. In a network with mobile access types, based on its specifications, it can generate speeds ofmore than 15 Mbps with a radius up to 3 km. This indicates that WiMAX technology can be used through the notebooks and PDAs which can be implemented on mobile phones In this paper, the calculation of video streamingparameters on the network of WiMAX 802.16 analyzed were path loss, bit energy to noise ratio bit error rate packet loss probability of streamingvideo delay end-to-end throughput as well.

II.METHODOLOGY

The first step of methodology used in this paper is modeling the system in order to simplified architecture of end to end

WiMAX network created to facilitate the calculation and analysis of data end-to-end delay. Figure. 1.below shows the picture of end-to-end delay of videostreaming in IEEE 802.16d WiMAX network.

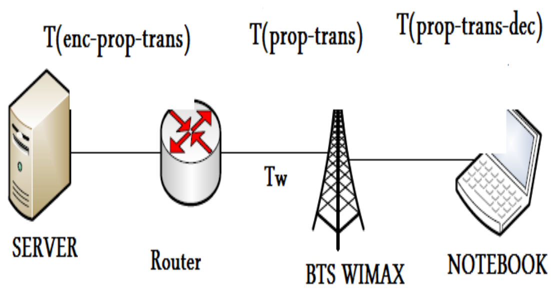

Figure. 1. Modeling end-to-end Delay on the 802.16d WiMAX network.

Based on that model Performance parameters of video streaming on the 802.16d WiMAX network being analyzed include the end to end delay, propagation losses, energy bit per noise, bandwidth, probability of bit error, packet loss, and throughput. Performance is reviewed from several conditions, namely LOS, NLOSoutdoor and indoor NLOS.

III. RESULTS AND DISCUSSION

The calculation of performance parameters of videostreaming on the 802.16d WiMAX network, consist ofthe value of path loss, RSL, the probability of bit errorspacket loss probability, end to end delay and throughput. All performance parameters are computed
on LOS and NLOS conditions. To simplify the processof analysis and calculation, some secondary data used isas shown in Tables 1and 2, it shows the specificationsof the base station and Customer PremisesEquipment on the WiMAX IEEE 802.16d.

Table(1)
Base Station Device Specification.

Parameter	Value
Power Transmitter	27 dbm
Maximum EIRP	44dbm

Table (2)
Subscriber Station Device Specification

Parameter	Value	
profile	Outdoor NOLS	Indoor NOLS
Receiver power	24dbm	24dbm
Antenna Gain	17dBi	17dBi

A. Calculation of Propagation loss (Path loss).

LOS Condition

The calculation of LOS propagation loss is often called the Free Space Loss. The calculation of this attenuation will be used to calculate the amount of power received by the receiver signal level. In this condition the value of free space loss will be calculated if the distance between the transmitter andthe receiver changes from a distance of 1 km - 15 km and if the system works at a frequency of 3.5 GHz. By using equation (1), loss propagation at a distance of 1 km in LOS conditions can be calculated as follows[5]:

free space loss = 32.45 + 20 log d + 20 log f…………………………..……………….(1)

free space loss =32.45+20log1+20log3500 =195

By using equation (2), the calculation of the signal levelat the receiver can be calculated as follows:

Receive signal level = maximum EIRP – Free space loss + Gr……………………………(2)
Receive signal level = 44-195.6604+17 = -134.6604 dBm.

With the same calculations for different distances
between the base station to the subscriber station, the obtained results as shownin Figure.2

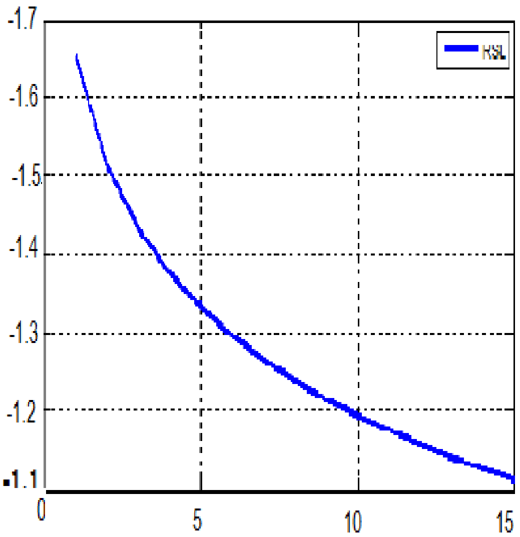

Figure. 2. Graph of the distance values at receive signal level LOS

Figure. 2. shows that the greater the distance between base station and Subscriber station, the smaller Receive space loss received power level of theReceiver.

Non Line of Sight (NLOS) Conditions

In this condition, the value loss of NLOSpropagation will be calculated with the distance between the transmitter and the receiver changes from a distance of 1 km - 5 km. By using equation (3), then value of path loss in NLOS conditions can be calculatedas follows:

Path loss = A+ 10 γ Log (d/d0) + ΔPath loss frequency + Path loss height +S…………..(3)

For the distance between transmitter and receiver as faras 1 km, the value of path loss can be calculated by using the steps as follows:

Calculation of reference path loss value (A)

A= 20 log(4πd0/λ)…………..……………(4)

With λ= c/f = 0,086 m.

d0 = 100 m. Than

A=20 log(4×3.14×100 /0.086)= 83.32 dB.

Calculation of path loss (γ).

γ = a - b.h+ c/ht ………………...………….(5)

If the area observed is assumed in urban areas, the value of a, b and c using the data in Table 3 for the terrain type B.

Table (3)

Parameter for different types of terrain

Parameter	Type A	Type B	Type C
A	4.6	4	3.6
B	0.0075	0.0065	0.005
C	12.6	17.1	20
Effect shadow(s)	10.6	9.6	8.2

-Calculation of the frequency correction factor (ΔPath loss frequency)
If frequency = 3.5 GHz = 3500 MHz, then
γ = 4 - 0,0065 × 32+ 17.1/32=4.32
the frequency correction factor (ΔPath loss frequency) value isΔPath loss frequency = 6 log 3500/2000= 1.4582
Calculation of antenna height correction factor
user (ΔPath loss height).
= - 10 .81Log (Hr / 2) ……………(6)
ΔPLh
If r = 2 m, then:
ΔPath loss height = -10.81 Log(2/2)=0

Shadow fading variation (s)S value can be seen in Table 3. For the terrain type B,the value of s = 9.6 dB. For different types of terrain,the magnitude of the constants a, b, c, and the shadow effect (s) which depends on the type of terrain it can beseen in Table 3. Having obtained the required values the calculated value of the path loss for NLOS conditions with a distance of transmitter and receiver as far as 1 km as follows:
Path loss= A+ 10γ Log (d/d0) +ΔPath loss frequency + ΔPath loss height +S
Path loss =
83.2942+10×4.32Log(1000/100)+1.4582+ 0+9.6=137.6451dB.

In NLOS condition, two types of Customer premises equipment were used, ie outdoor and indoor NLOS with the antenna gain respectively - each of 17 dBi and 13 dBi. By using equation (3.7), the calculation of the signal level at the receiver side with NLOS outdoor Customer premises equipment and the distancebetween base station and subscriber station as far as 1 km can be calculated asfollows:
Receive signal level (dBm)=EIRP-Path loss+ Gr
………………………………………..(7)
=44-137.6451+17= -76.6451 dBm

On the other hand, the calculation of the signal level at the receiver side with indoor NLOS customer premises equipment and the distance between base station and subscriber station as far as 1 km can be calculated as follows:
Receive Signal Level (dbm)= EIRP-PathLoss +Gr
44-137.6451+13= -806451dbm

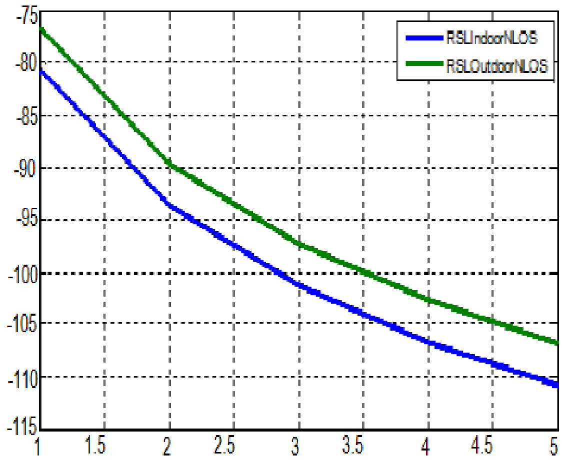

Figure. 3. Graph of receive signal level value and distance on NLOS.

Based on Figure. 3, it can be seen that the greater the distance between base station and subscriber station, give greater the value of path loss. Fig. 3 also shows a comparison of the receive signal level to the distance in NLOS conditions. The farther the distance between base station and subscriber station, receive signal level value will lower itmeans that power received of receiver getting weaker.

B. Calculation of Energy-bit per Noise (bit energy /noise ratio) The calculation of bit energy / noise ratio value will be used for themeasurement of bit error probability. In the calculationof bit energy / noise ratio

below, use the under conditions LOS lowest
value of receive signal level, ie -188.8214 dBm and 106.8852 dBm outdoor NLOS and -110.8852 dBm in indoor NLOS.

Condition of Line of Sight (LOS)

The calculation of bit energy / noise ratio with the bandwidth (B) =3.5MHz, using quadrature phase shift keyed modulation technique with a data rate (R) used = 2.6 Mbps is as follow:

Bit energy/noise ratio= receive signal level – 10 Log (R) + 228.6 dbw – 10 Log Tc ……(8)
= -188.8214 – 10 Log (2×10) + 228.6 dBW – 10 Log (237+ 37) = - 165.2973 dB.

In the same way to obtain the value of bit energy / noise ratio for outdoor and indoor NLOS customer premises equipment using quadrature phase shift keyed modulation technique 4 Mbps data rate, 16-quadrature amplitude modulator with data rate 5.3 Mbps and 7.9 Mbps, and 64-quadrature amplitude modulator with data rate 11.9 Mbps and 13.2 Mbps (Table 4).

Table (4)

Value bit energy/noise ratio of modulation technique in LOS and NLOS conditions

Mod	**Eb/No**		
	LOS	**Outdoor NLOS**	**Indoor NLOS**
QPSK 2.6Mbps	2.9530 e-017	4.6120 e-009	1.8361 e-009
QPSK 4Mbps	1.0952 e-017	1.7104 e-009	6.8093 e-009
QAM-16 5.3Mbps	5.7289 e-018	8.9473 e-010	3.5620 e-010
QAM-16 7.9Mbps	2.2851 e-018	3.5689 e-010	1.4208 e-010
QAM-64 11.9Mbps	8.8969 e-019	1.3895 e-010	5.5317 e-011
QAM-64 13.2Mbps	7.0075 e-019	1.0944 e-010	4.3569 e-011

Table 4 shows that the greater the data rate used, the smaller the value of bit energy per noise. Energy value of the smallest bit per noise present in LOS conditions, while in NLOS conditions, customer premises equipment outdoor NLOS noiseenergy per bit larger than the indoor NLOS.

C. Calculation of bandwidth of video Streaming will be analyzed using theH.264/AVC video codec with codec bandwidth between64kbps - 240 Mbps and AAC-LC audio codec for thecodec bandwidth of 16-576 kbps. The format used is Communication infrastructure fee image with a frame rate of 30ms. By usingequations 9 and 10 it will get the value of streamingvideo data packets on IEEE 802.16d WiMAX networkusing Internet protocol video 6, namely:

Path loss audio = Bandwidth of audio x frame rate ………………………………………(9)
= (64.103) bps x (30.10-3) s = 1920 bit

Path loss video = Bandwidth of video x frame rate……………………………………(10)
= (224.103) bps x (30.10-3) s = 6720 bit

So that large data packets streaming video on IEEE 802.16d WiMAX network using Internet protocol video6 by equations 11are as follows:

Power of video streaming -size= headerUser datagrams protocol /Real-time transmission protocol /Internet protocol video 6+(Path loss audio + Path loss of video) ……………(11)
Bit= 480 +(6720 + 1920) = 9120
=1140 byte

Big each packet of audio and video as well as the number of audio packets and video packets streaming video applications using IPv6 generated per second can be calculated as follows:
Power audio -size = headerUser datagrams protocol /Real-time transmission protocol /Internet protocol video 6 + Packet loss audio ....(12)
= 480 + 1920 = 2400 bit
Power video-size = headerUser datagrams protocol//Real-time transmission protocol /Internet protocol video 6 + Packet Loss video………………………………..(13)
= 480 + 7200 =7200 bit
Power of audio = bandwidth of audio /path loss audio ………………………..……(14)
= (64.103) bps / 1920 bit = 33,333 packet/s
Power video = power of audio/ packet loss video……………………………….……(15)
= (224.103) bps / 6720 bit = 33,333 packet/s
Bandwidth of audio = Power of audio - size x Power of audio……………….……….(16)
= 2400bit x 33,333 packet/s
= 79999,2bps = 80 kbps
Bandwidth of video = Power of video-size x Power video……………………………(17)
=7200bit x 33,333 packet/s
= 239997,6 bps = 240 kbps
So the actual bandwidth of video streaming that is expressed by the equation 18:
Bandwidth of video streaming= Bandwidth of video + bandwidth of audio + bandwidth overhead ………………………………(18)
bps + 80000 bps+(5%x (240000 + 80000)bps)
= 336000bps

D. Calculation of Loss packet video streaming the probability of packet loss in streaming video with headeruser datagrams protocol / real-time transmission protocol / Internet protocol is 60 bytes ((8 byte User datagrams protocol header Real-time transmission protocol header 12 bytes, and 40 byte Internet protocol header)) and payload of 840 bytes of
video and audio payload of 240 bytes[6]:

=(240 + 840 + 60)x 8 x 10-7
=9,120 ×4-10

Condition of Line of Sight (LOS).

The value of the BER, or often called the probability of bit error using Quadrature phase shift keyed modulation technique with 2.6 Mbps data rate and bit energy / noise ratio = 2.9530e-017.

Conditions Non Line of Sight (NLOS).

The calculation of the value of bit error probability and packet loss for NLOS conditions equal to the calculations in LOS conditions, where the difference is only on the value of bit energy / noise ratio only.

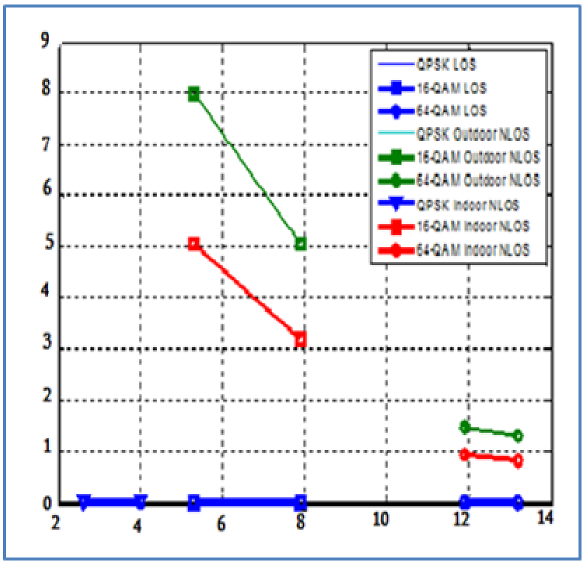

Figure.4. Graphbit error rate of WiMAX 802.16d network.

Based on the figure4. it can be seen that the value of biterror probability is very small in LOS conditions. Whilein NLOS conditions, the probability of bit error in theNLOS outdoor larger than the indoor NLOS. This can occur because of differences in customer premises equipment specifications areused in both circumstances.

Table (5)
Probability Packet Loss Video Streaming

Type of modulation	**Probabilty of packet loss**		
	LOS	**Outdoor LOS**	**Indoor LOS**
QPSK 2.6 Mbps	e9.1200 -004	9.1200 e-004	9.1200 e-004
QPSK4 Mbps	9.1200 e -004	9.1200 e-004	9.1200 e-004
16-QAM 5.3Mbps	9.1200 e-004	9.2000 e-004	9.1705 e-004
16-QAM 7.9Mbps	9.1200 e-004	9.1705 e-004	9.1519 e-004
64-QAM 11.9Mbps	9.1200 e-004	9.1346 e-004	9.1292 e-004
64-QAM 13.2Mbps	9.1200 e-004	9.1330 e-004	9.1282 e-004

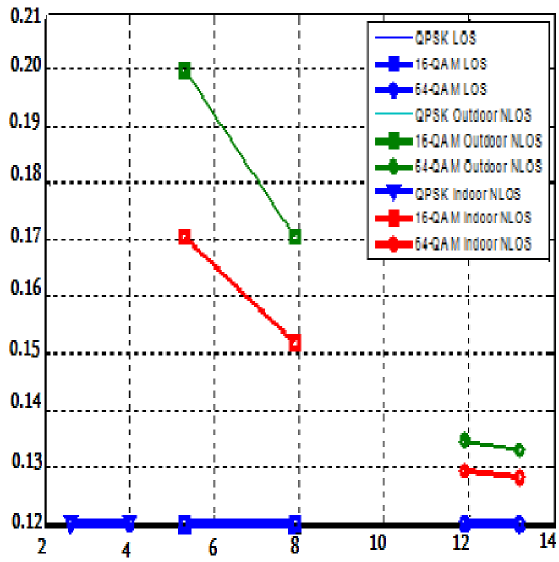

Figure. 5. Graph of Packet Loss probability of Video Streaming on LOS and NLOS condition.

Figure. 5 shows the relationship between the packet loss probability of video streaming with data on LOS and NLOS conditions. In quadrature phase shift keyed modulation type the data rate of 2.6 Mbps and 4 Mbps, the packet loss probability is very small streaming video since thevalue of bit error is also small. While on the quadrature amplitude modulator modulation type, the higher the data rate, the lower the probability of packet loss video streaming.

IV.CONCLUSIONS

Based on the calculation and analysis of the videostreaming performance on the 802.16d WiMAXnetwork, the conclusion is obtained as follows: Thepacket loss probability of video streaming in LOSconditions have the same value on all modulationtechniques, ie 9.1200 x 10-4. This can occur becausethe value of bit error probability is very small. On theother hand, in NLOS conditions by using QPSKmodulation technique the value is 9.1200 x 10-4. UsingQAM techniques, the value of packet loss probability is inversely proportional to data rate.

تحليل تشغيل الفيديوالفعلي (Video Stream) عالميا باستخدام الشبكة اللاسلكية (واي ماكس 802.16d)

أنس بكوري

المستخلص:-في السنوات الأخيرة بدا ازدياد طلب خدمات المعلومات كثيرا لغرض الوصول الي البيانات بسرعه عالية ومشاهده الفيديو في الوقت الفعلي تمثل دلك فيالشبكات الصوتية والفيديو باستخدام انترنت بروتوكول (IP). ويمكننا استخدام تقنيه streaming من عرض الفيديو في الوقت الفعلي . ولكنه يؤثر علي عرض النطاق. عدم وجود عرض نطاق جيد لstreaming سوف يسبب في الفقد والتأخير بشكل كبير . في حال الحصول علي خدمات streamingجيده يجب ان تنفد علي شبكات دات سرعه بيانات عالية ونطاقات كبيره.

ويمكن الحصول علي هده المتطلبات باستخدام شبكات wimax802.16d ودلك لا أنها مبنيه علي معايير دوليه وهي IEEE802.16 والتي تمكن من نقل البيانات عبر نطاقات دات عرض نطاق كبير لاسلكيا وتكون بديله عن الاسلاك او DSL. Wimax802.16d يمكن ان يوفر نقاط الوصول التالية:- المضبوطةوالمحمولةوالجوالة في مجال الرؤيةLOS وليس في مجال الرؤيةNLOS.

وبناء علي الحسابات وبتغيير المسافات من 1 الي 15 بين المرسل والمستقبل في حاله LOS من 1 الي 5 في حاله NLOS وجدنا ان قيم فقد الانتشار في NLOS هو اكبر بكثير من LOS وقيمه احتماليه خطأ البث في LOS اصغر من احتماليه البت في NLOS في كل انواع التضمين وافضل حاله في LOS تكون عند استخدام تضمين QPSK والتي يكون فيها معدل البيانات 2.6 واحتماليه خطأ البت 2.6x10-45 واحتماليه فقد الحزم في Streamingللفيديو يساوي 9.12 x10-4

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