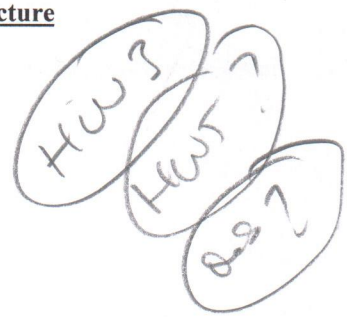
BLG 609E – Special Topics: 4G Wideband Wireless Network Architectures (Spring 2012)

Homework Assignment #8: QoS and Mobility Management

Due Date: April 16th (Monday), 2012 at start of lecture

NO Late submissions.

TOTAL POINTS: 15 points



Mobility Related

1. Consider the following scenario:

   MN is first attached to LAN1, and configured an IP address (IP1). HA1 is the home agent located in LAN1.

   Later, MN moved to LAN2, and configured another IP address (IP2). HA2 is the home agent located in LAN2.

   Finally, MN moved to LAN3 and configured another IP address (IP3).

   Ideally, if the MN wants to receive its traffic destined to IP1 while it is attached to LAN3, it shall be able to send a Mobile IP Registration Request to HA1 for binding IP1 to IP3 (assume co-located care-of address mode).

   But consider the (imaginary!) scenario where the MN can only be sending Mobile IP Registration Requests from serving LAN to the previous LAN at any point in time. For example, from LAN3 to LAN2, but not to LAN1.

   How can the MN ensure it can receive the IP traffic destined to IP1 while the MN is connected to LAN3? Describe the actions it needs to take. **(5 POINTS)**

QOS Related

1. **(5 POINTS)** Consider the following IP flows and their QoS requirements.

   IP Flow-1: QCI = 3, ARP = {10, pre-emption capability = no, pre-emption vulnerability = yes}, GBR = {DL= 400, UL = 300} kbps {real time gaming, playing "call of duty MW2"}

   IP Flow-2: QCI = 7, ARP = {12, pre-emption capability = no, pre-emption vulnerability = yes}, MBR = {DL =50, UL = 50} kbps {VoIMS conversation with his "call of duty MW2" friend}

   IP Flow-3: QCI = 7, ARP = {12, pre-emption capability = no, pre-emption vulnerability = yes}, MBR = {DL 300, UL = 300} kbps { IMS video connection with his "call of duty MW2" friend}

   IP Flow-4: QCI = 5, ARP = {9, pre-emption capability = no, pre-emption vulnerability = yes}, MBR = {DL =100, UL = 100} kbps {IMS signalling flow}

   IP Flow-5: QCI = 7, ARP = {14, pre-emption capability = no, pre-emption vulnerability = yes}, MBR = {DL = 300, UL = 50} kbps {watching tv off the web}

   Assume that the AMBR for the subscriber is DL-AMBR = 2 Mbps, UL-AMBR = 500 kbps

a. How many bearers will need to be created to support these IP flows?

b. Which IP flows will be grouped onto which bearer?

c. What would be the QoS parameters associated with each bearer?

2. (**5 POINTS**) Assume that an operators has three categories of subscribers: gold subscribers, silver subscribers and bronze subscribers. The operator wants to offer service such that:

   i. A higher grade subscriber cannot pre-empt the existing bearer of a lower grade subscriber.

   ii. If emergency calls need to be setup and there is congestion in the network (say during fire situation), lower grade subscribers should be pre-empted before higher grade subscribers.

   Please choose ARP parameters (value, pre-emption capability, pre-emption vulnerability) for these three grades of subscribers to meet the objectives of the operator

16.03.2012

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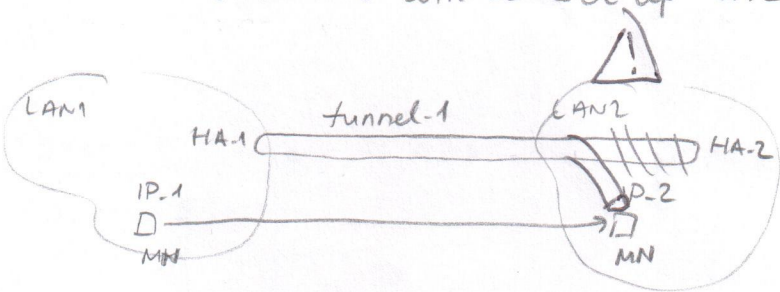
BLG 609E: Special Topics: 4G Wideband Wireless Architectures

Homework Assignment: 8: QoS & Mobility Management

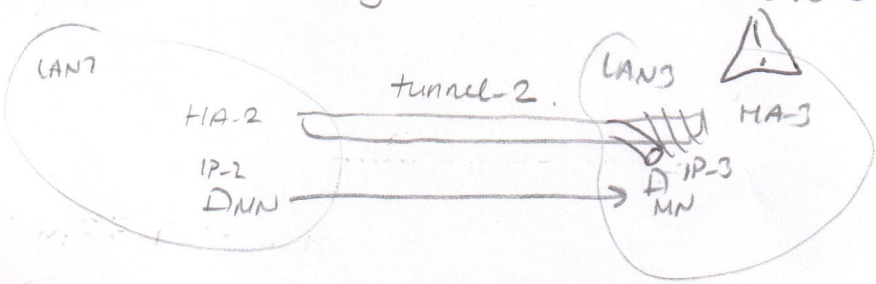
- Mobility Related -

1) (4) In the scenario where MN can send "Mobile IP Registration Request" from serving LAN only to previous LAN at any point in time, to ensure it can still receive the packets destined to its first point of attachment, MN should perform registering at every LAN it transpasses and tunnels should be set up hop by hop.

In example scenario, after MN moves to LAN2 and configures another IP address (IP2), he should connect to HA2 and send Mobile IP Registration Request. Thereafter a tunnel will be set up and IP-1 & IP-2 would be binded.



then if MN moves to LAN3, similarly, he should connect with HA3 and HA3 and HA2 should communicate to set up a tunnel and forword packets coming to IP2 to IP3 vice versa.



MN can then ensure it can receive IP traffic destined to IP1 while he is connected to other LANs with hop by hop tunnelling.

– QoS Related –

1) a) 4 bearers will need to be created to support these IP flows

b) Bearer 1: IP_Flow 1

Bearer 2: IP_Flow 2 + IP Flow 3

Bearer 3: IP_Flow 4

Bearer 4: IP_Flow 5 (not in priority order)

c) Bearer 1: QCI: 3, ARP: 10, GBR = { DL = 400 kbps, UL = 300 kbps } ← gets exactly what is required!
(IP Flow_1)

Bearer 3 QCI: 5, ARP: 9, MBR = { DL = 100 kbps, UL = 100 kbps } ← gets exactly what it wats because enough bw is left.
(IP Flow-4)

AMBR = 2 Mbps DL
500 kbps UL

Bearer 2 QCI: 7 ARP: 12 MBR = { DL = 50 + 300 = 350 kbps, UL = 50 + 300 = 350 kbps }
(IP Flows 2, 3)

AMBR = 2 Mbps DL
500 kbps UL

Bearer 4 QCI: 7 ARP = 14 MBR = { DL = 300 kbps, UL = 50 kbps }
(IP Flow 5)

AMBR = 2 Mbps DL
500 kbps UL

(check AMBR again: DL aggregated = 100 + 350 + 300 = 750 kbps ≤ 2 Mbps
UL aggregated = 100 + 350 + 50 = 500 kbps ≤ 500 kbps !)

2)

	GOLD	SILVER	BRONZE
ARP Value	1	2	3
Pre-emption Capability	no	no	no
Pre-emption Vulnerability	yes	yes	yes

higher ARP value lower the priority

- ARP values are chosen due to rule i.
- preemption capabilities are set to no in order to ensure rule ii. There will be another class named "emergency" and no regular class (gold, silver or bronze) should not pre-empt "emergency": so all preempton capabilities are set to "NO".
- "pre-emption vulnerability" quality represents, whether these classes' users can be preempted or not. in case without emergency exception, this property of gold users could be set to "NO" not to be preempted. However emergency calls need to preempt any calls existing in the network congestion phase.

"emergency calls"
- ARP value: 4
- pre-emption capability: YES
- pre-emption vulnerability: NO