

Multiple Backhaul Mobile Access Router

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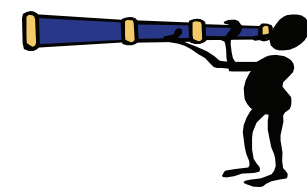
Group Mobility and Multiple Backhauls

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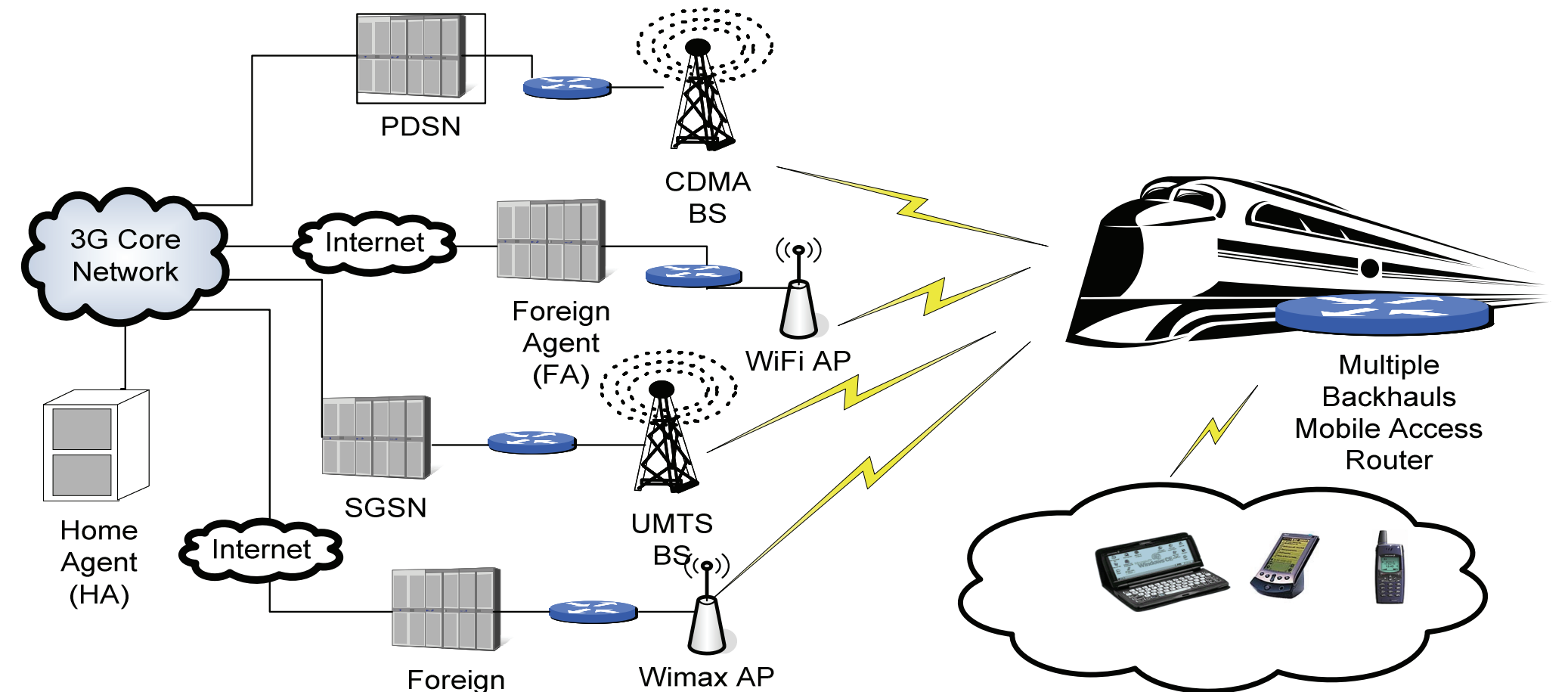
- ◆ Mobile access routers allow groups of users to connect to the Internet and remain connected as the router moves
- ◆ With multiple wireless backhauls MAR has a better chance of maintaining Internet connectivity as it moves.

Efficient Handover Algorithm:

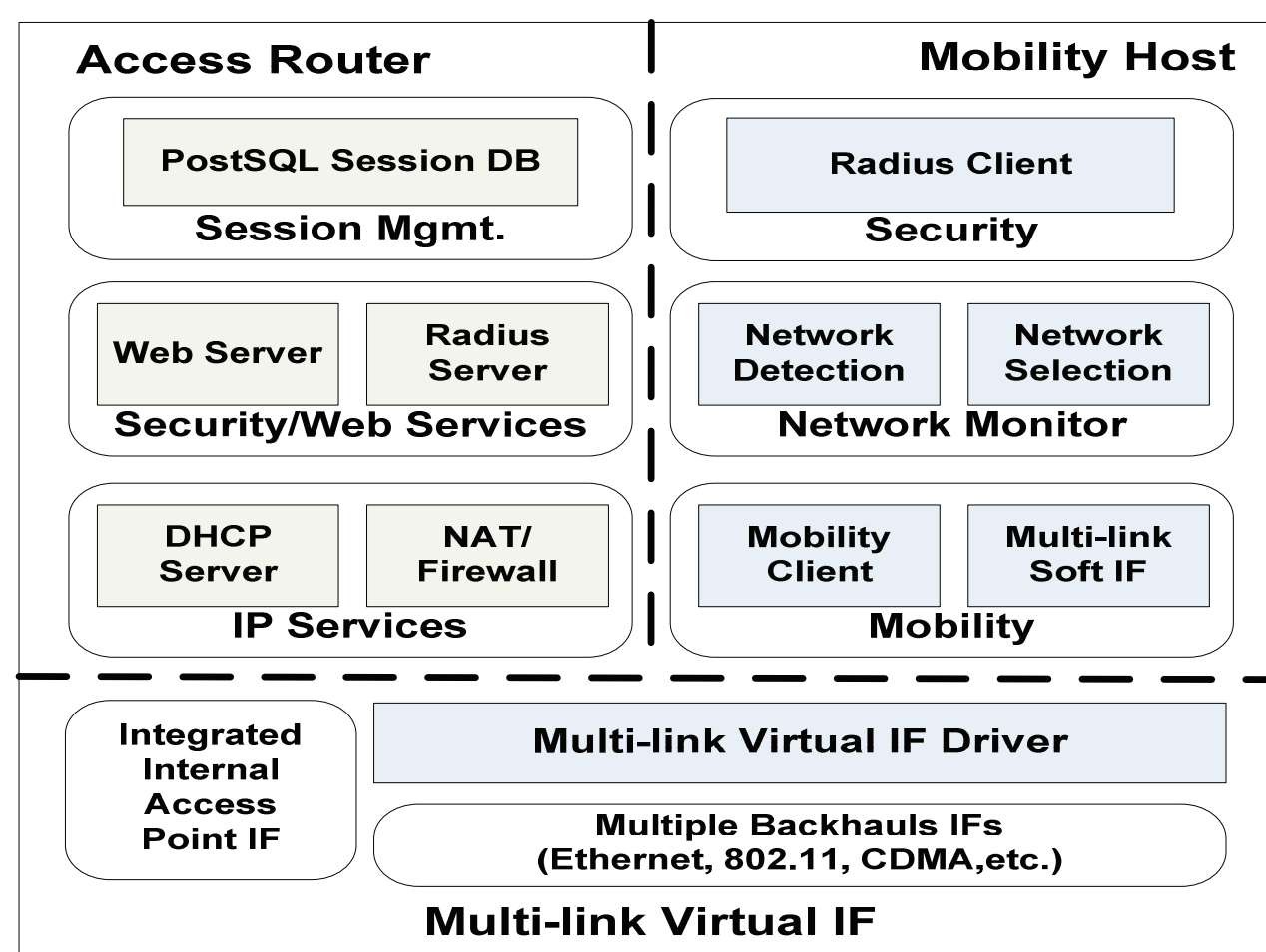
- ◆ to maintain high availability when switching between backhauls
- ◆ need thorough study of different link parameters and a common interface cross different wireless links.



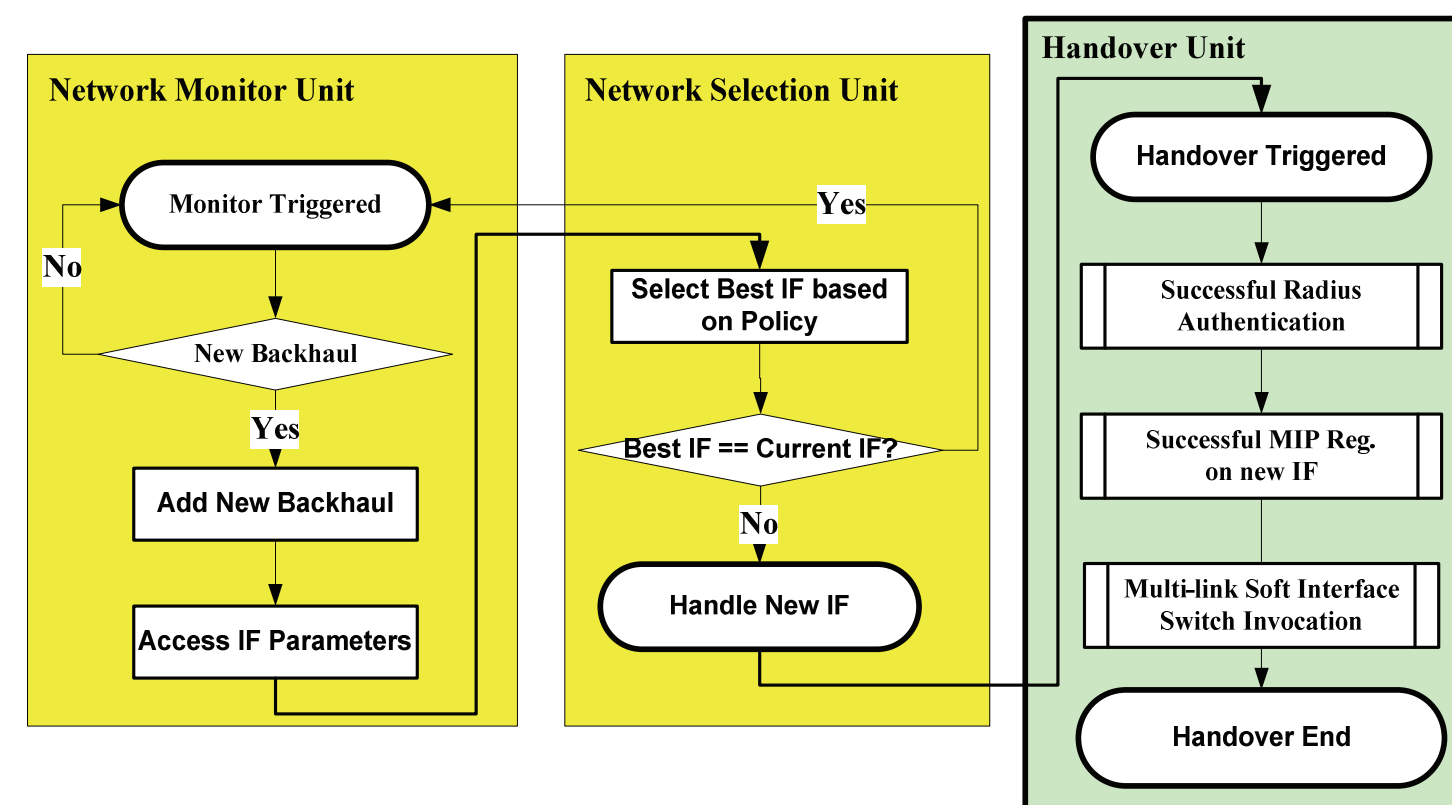
Multiple Backhaul MAR System



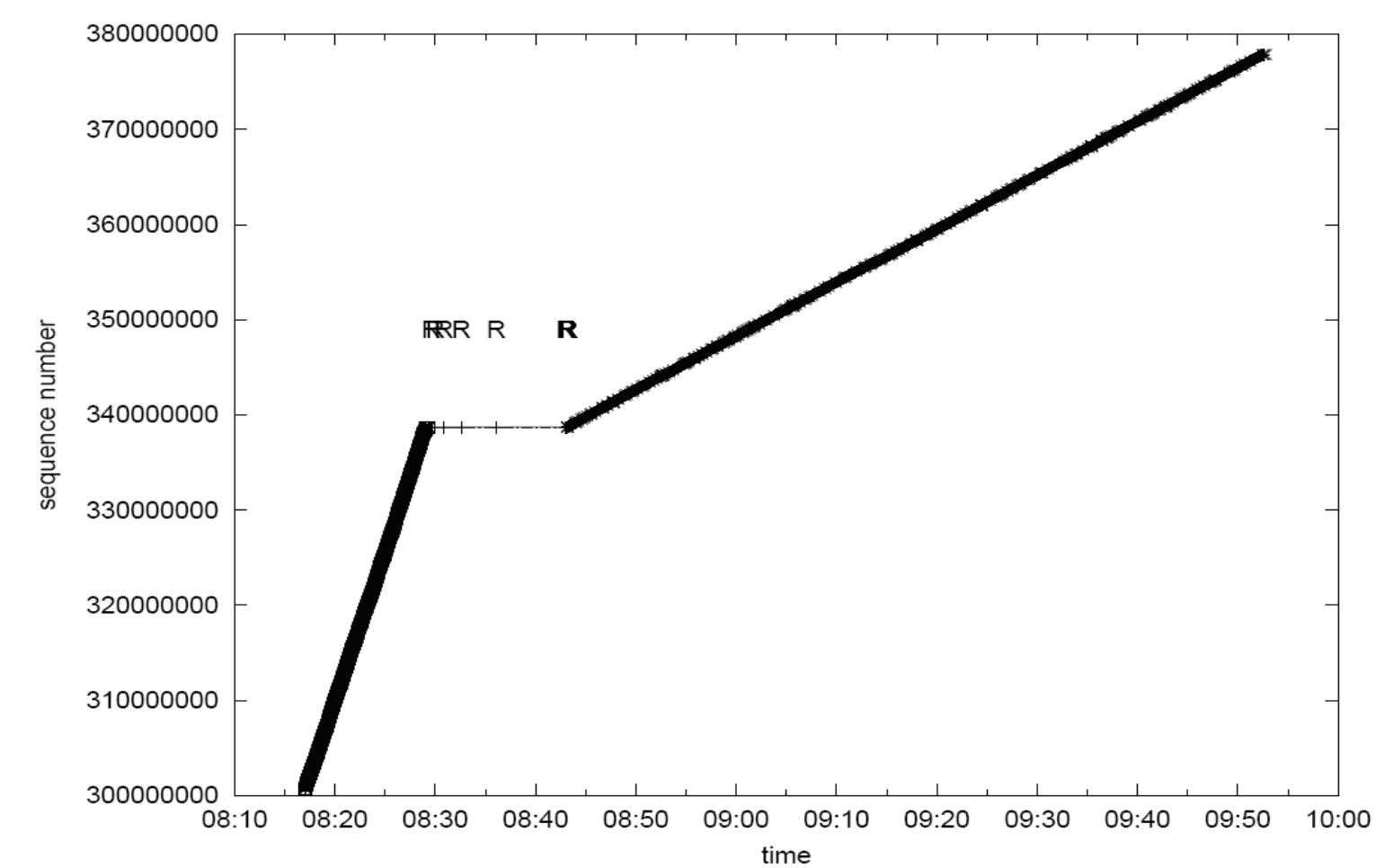
Software Framework



Vertical Handover Flow



Basic MAR Performance



Network Access APIs

Next is summary of major functions. If it starts with 'Get', the value is obtained from device; Otherwise, if it starts with 'Cal', it means the value is calculated.

Common APIs:

- `int GetMTU(char* InterfaceName);`
- `int GetRSSI(char* InterfaceName);`

APIs for 802.11 cards :

- `int GetNoise(char* InterfaceName);`
- `long GetBitRate(char* InterfaceName);`
- `double CalBitErrorRate(char* InterfaceName);`
- `double CalFrameErrorRate(char* InterfaceName);`

Improved Handover Policy

Threshold based handover policy utilizing network access APIs:

- Define primary link p and secondary link s ;
- Define SNR threshold T_{low}^p, T_{hi}^p and T^s ;
- Define measured parameter SNR^p and SNR^s ;

Algorithm:

If primary in service, it remains in use as long as $SNR^p \geq T_{low}^p$; If it is below T_{low}^p and $SNR^s \geq T^s$, switch to secondary link; Returns to the primary if $SNR^s < T^s$ or $SNR^p > T_{hi}^p$.

Vertical Handover Policy:

- ◆ **Persistent Policy:** set T_{low}^p to minimal SNR and T_{hi}^p also to a value close to T_{low}^p ;
- ◆ **Aggressive Policy:** set T_{low}^p and T^s to relative high values and set T_{hi}^p close to T_{low}^p ;
- ◆ **Predictive Policy:** set T_{low}^p above the minimal needs, set T_{hi}^p to relative high value.
- ◆ **Combined Policy:** add new thresholds for transmission rate, remain on the link with the highest rate but also avoid outages.

Summary and Future Work

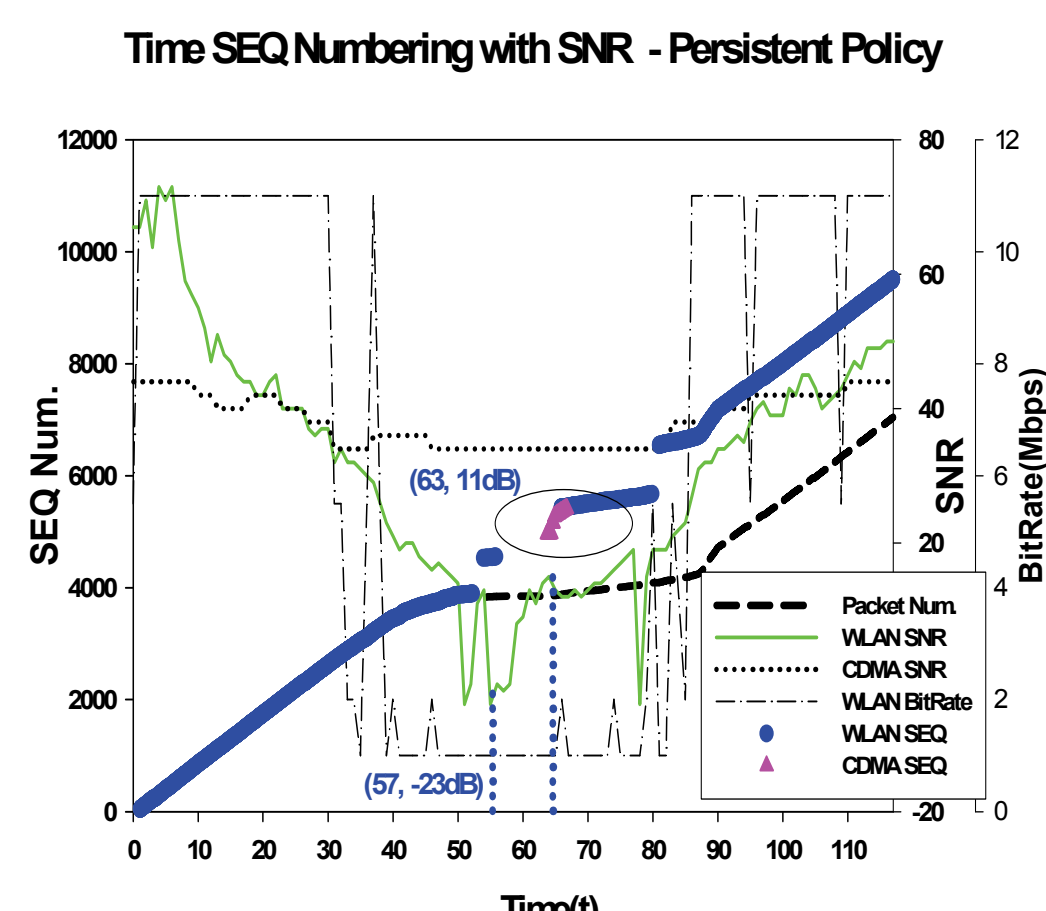
Summary:

- ◆ A flexible framework and the implementation of a Multiple Backhauls Mobile Access Router
- ◆ A set of backhaul interface monitoring APIs
- ◆ Enhanced handover policies utilizing the APIs based on different requirements
- ◆ Experiments for basic MIP and Simple IP vertical handover.

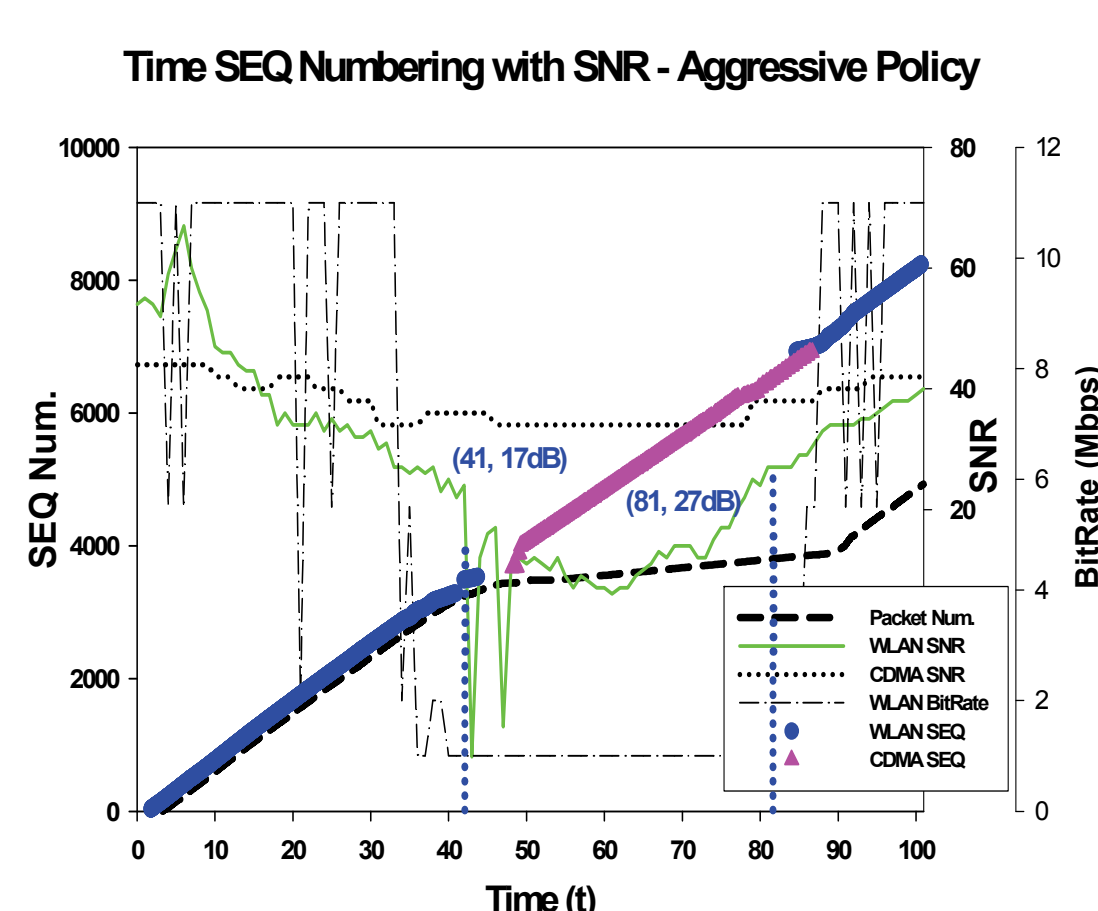
Future work:

- ◆ Evaluate the performance for Mobile IP vertical handover across different wireless links
- ◆ Extend the handover policies to more sophisticated decision model.

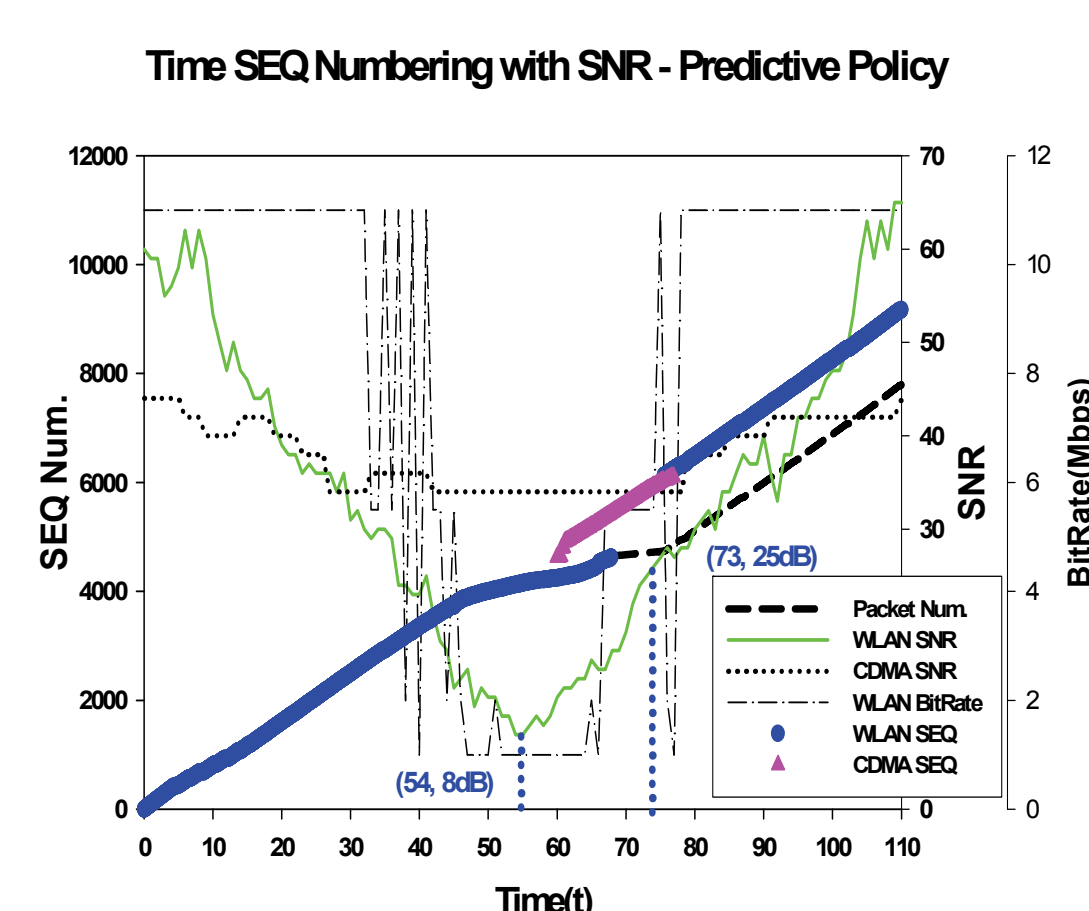
Enhanced Vertical Handover Performance Evaluation



Threshold: T_{low}^p [0] T_{hi}^p [10] T^s [30]



Threshold: T_{low}^p [20] T_{hi}^p [25] T^s [40]



Threshold: T_{low}^p [10] T_{hi}^p [20] T^s [30]

