

A VERTICAL HANDOFF MECHANISM FOR MULTIMEDIA STREAMING SERVICES

**Authors: Chung-Ming Huang,
Chao-Hsien Lee,
Chi-Shuai Yeh**

**Presented by Chao-Hsien Lee
(leech@asia.edu.tw)**

ABSTRACT

- A mobile device equipped with multiple wireless access capabilities becomes gradually a leading trend.
 - For example, dual-mode mobile phone (3G+WLAN)
- Users may suffer vertical handoffs during their movement in a heterogeneous network environment.



ABSTRACT

- Most current handoff solutions are based on received signal strength (RSS).
 - RSS with threshold (RSS-T)
 - RSS with hysteresis and threshold (RSS-HT)
- In this paper,
 - We proposes a vertical handoff mechanism (**RSS-AHT**) to adapt hysteresis dynamically.
 - We employs the Session Initiation Protocol (SIP) and the MPEG-4 Fine Granularity Scalability (FGS) to maintain the streaming quality during the handoff operation.



OUTLINE

- Introduction
- System Architecture
 - SIP-based Handoff Mechanism with Adaptive Hysteresis
 - Scalable Multimedia Content Delivery
- Performance Evaluation
- Conclusion



INTRODUCTION (1/3)

- The trend of mobile devices
 - Small
 - Light-weighted
 - Great computing power
 - Multiple wireless network interfaces
- Different access technologies can provide different signaling coverage and transmission bandwidth
 - WLAN: high data rate but narrow coverage
 - 3G: wide coverage but low data rate



INTRODUCTION (2/3)

- RSS with threshold (RSS-T)
 - A signal threshold is defined.
 - Handoff will happen when the signal received from the current BS drops below the predefined threshold.
 - This method can alleviate too many unnecessary handoffs when the signal strength received from the current BS is strong enough.
 - Ping-pong effect



INTRODUCTION (3/3)

- RSS with hysteresis and threshold (RSS-HT)
 - A threshold and a hysteresis margin are defined.
 - The handoff decision is taken only when
 - 1) the signal strength of the serving BS is lower than a threshold
 - 2) the surrounding BSs' signal strength is higher than the serving BS's signal strength plus a hysteresis margin.
 - High handoff delay



SYSTEM ARCHITECTURE

- The motivation of this paper
 - RSS-T: high transmission throughput
 - RSS-HT: few redundant handoffs

→ Make the hysteresis margin dynamic and adaptive

- The assumption of this paper
 - We take dual-mode (3G + WLAN) mobile devices into consideration.
- The objectives of vertical handoff
 - To determine the next access network
 - To recover the original streams for session continuity



ADAPTIVE HYSTERESIS

- The proposed adaptive hysteresis is designed to be inversely proportional to the handoff interval.

$$\Delta' = \Delta \times e^{(-T/\lambda)}$$

- Δ denotes the predefined hysteresis margin
- Δ' denotes the adaptive hysteresis margin
- T denotes the time interval between the previous handoff and the current time
- λ denotes the interval coefficient
 - If λ is large, Δ' spends long time to decrease to 0.
 - If λ is small, Δ' spends short time to decrease to 0.

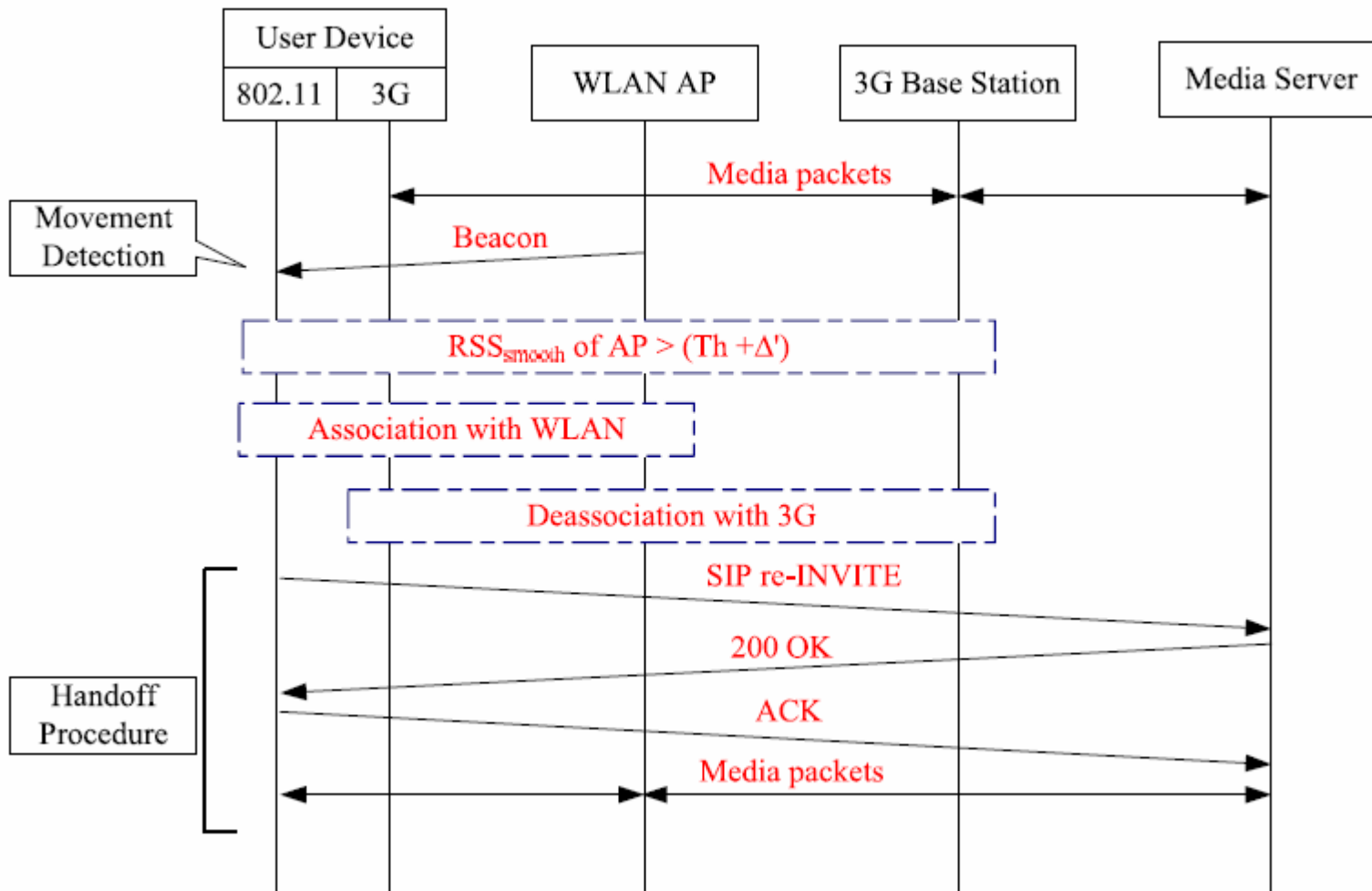


SIP-BASED HANDOFF

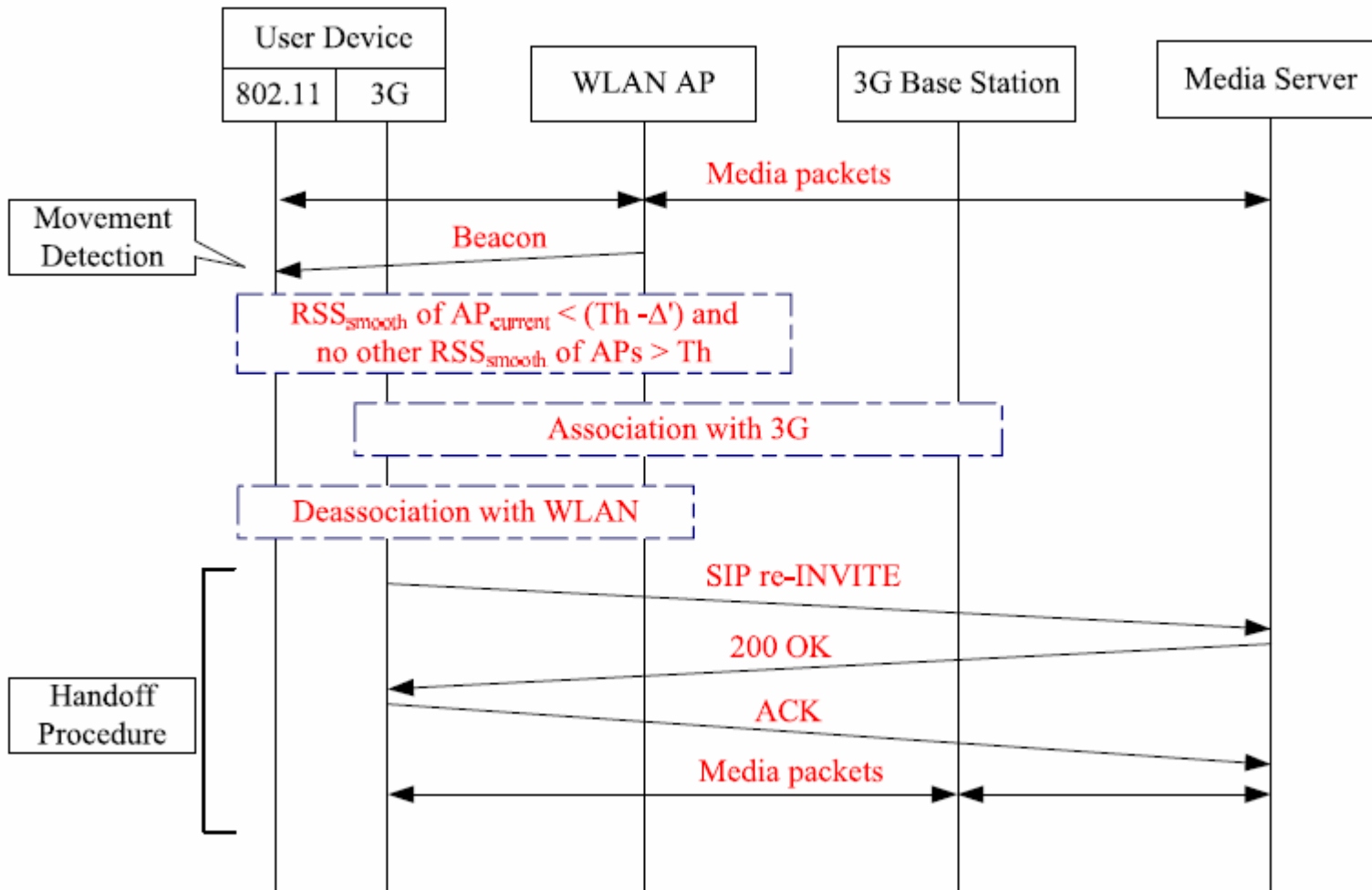
- A vertical handoff would re-establish the original session using the Session Initiation Protocol (SIP).
 - The user should send a re-INVITE request to the communicating node.
- Two handoff operations
 - 3G-to-WLAN operation
 - WLAN-to-3G operation



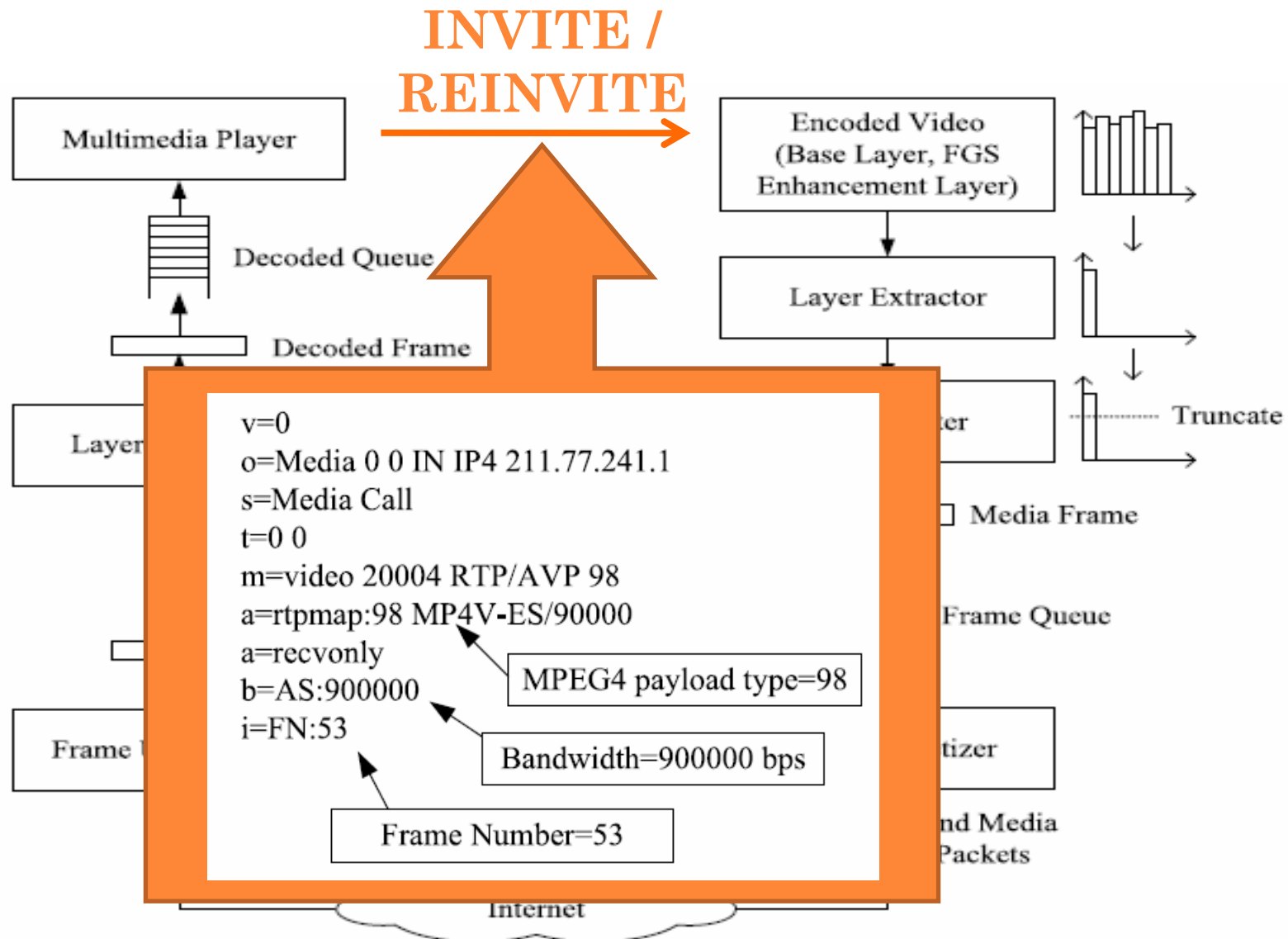
3G-TO-WLAN OPERATION



WLAN-TO-3G OPERATION

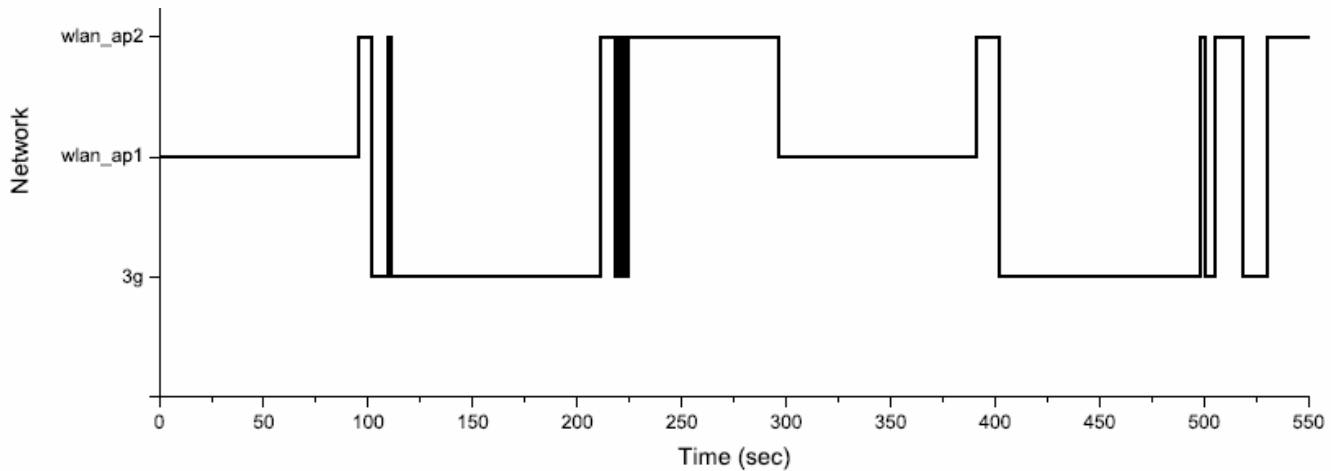
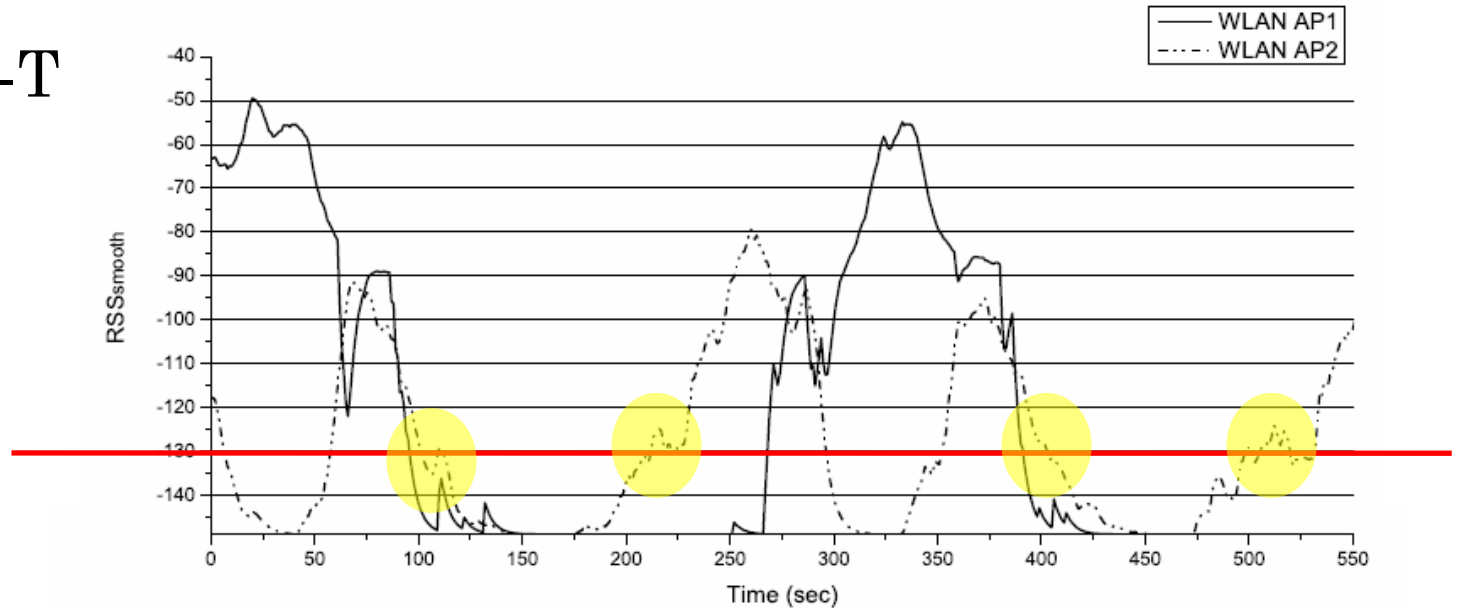


SCALABLE MULTIMEDIA CONTENT DELIVERY



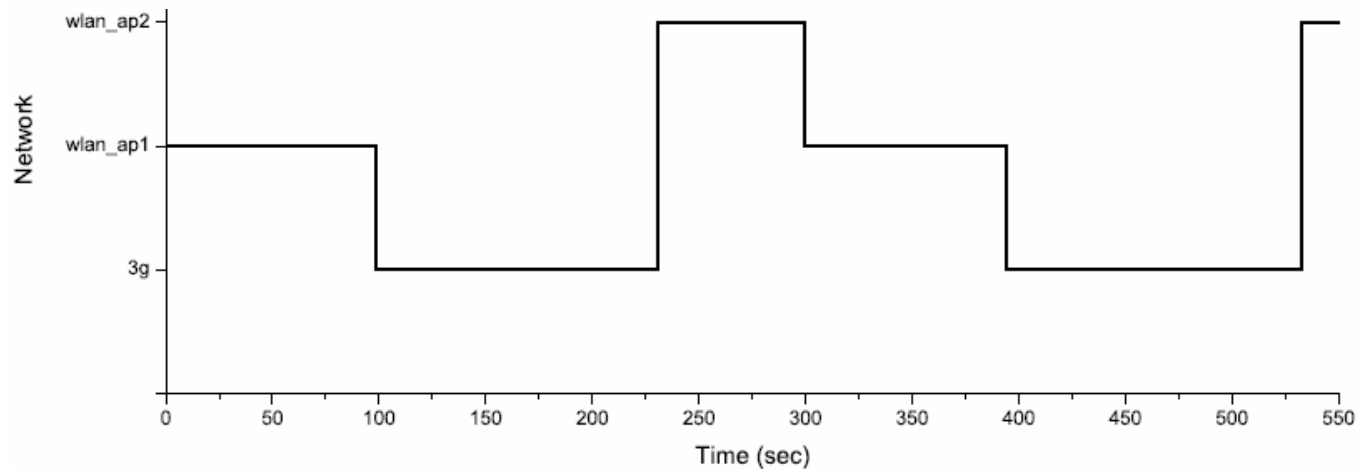
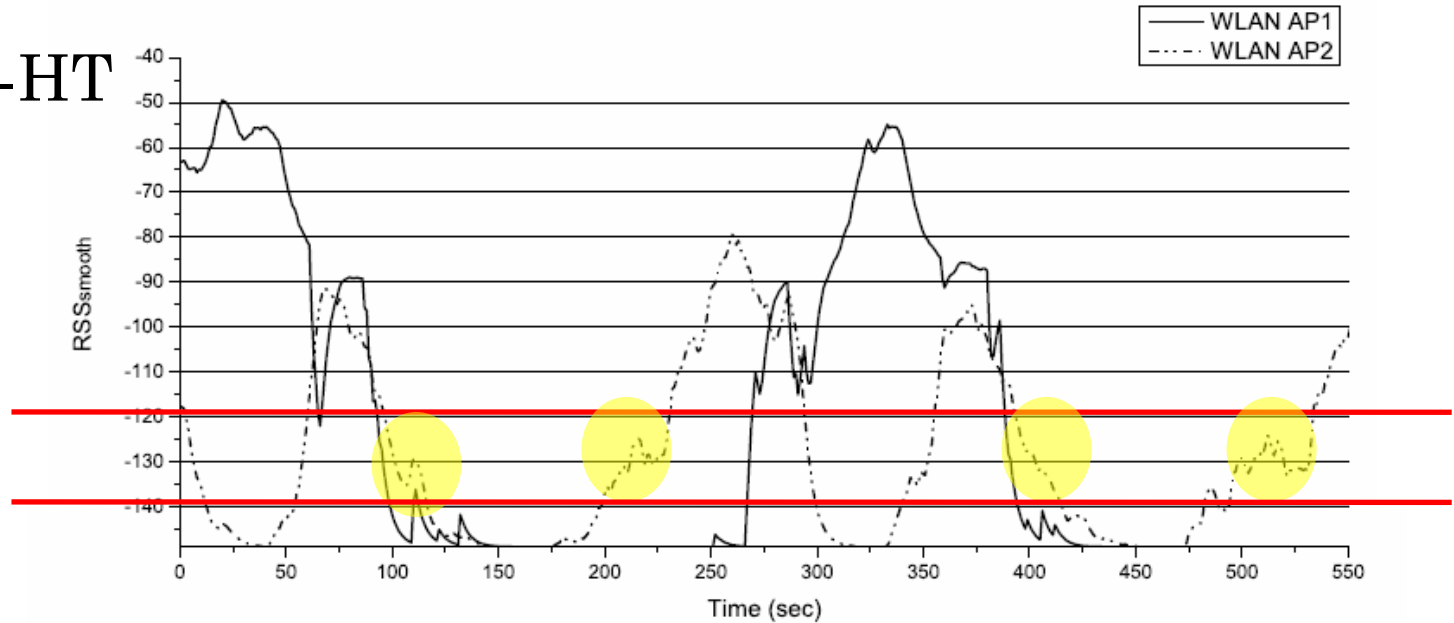
PERFORMANCE EVALUATION (1/4)

○ RSS-T



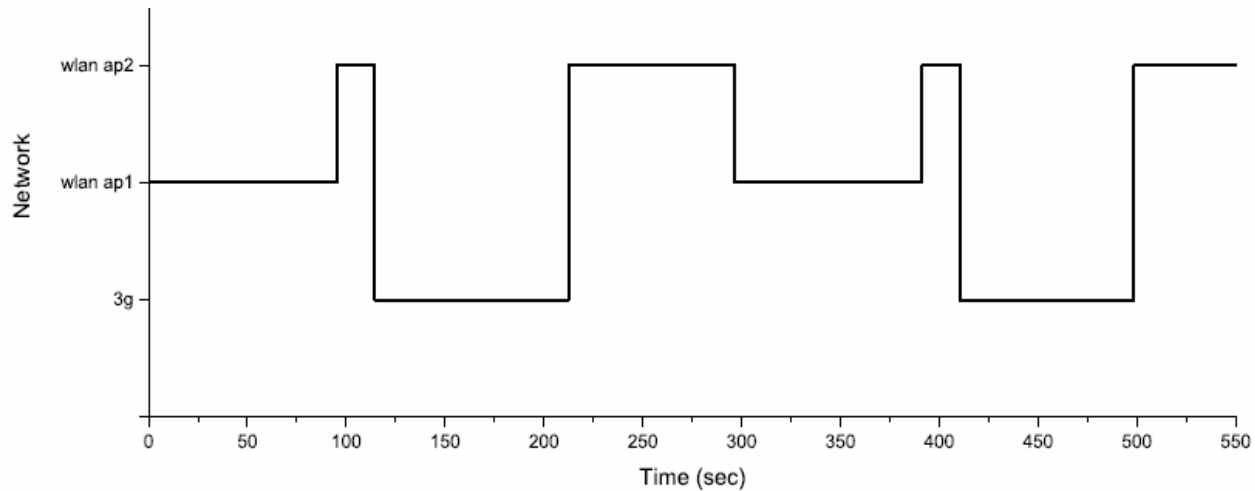
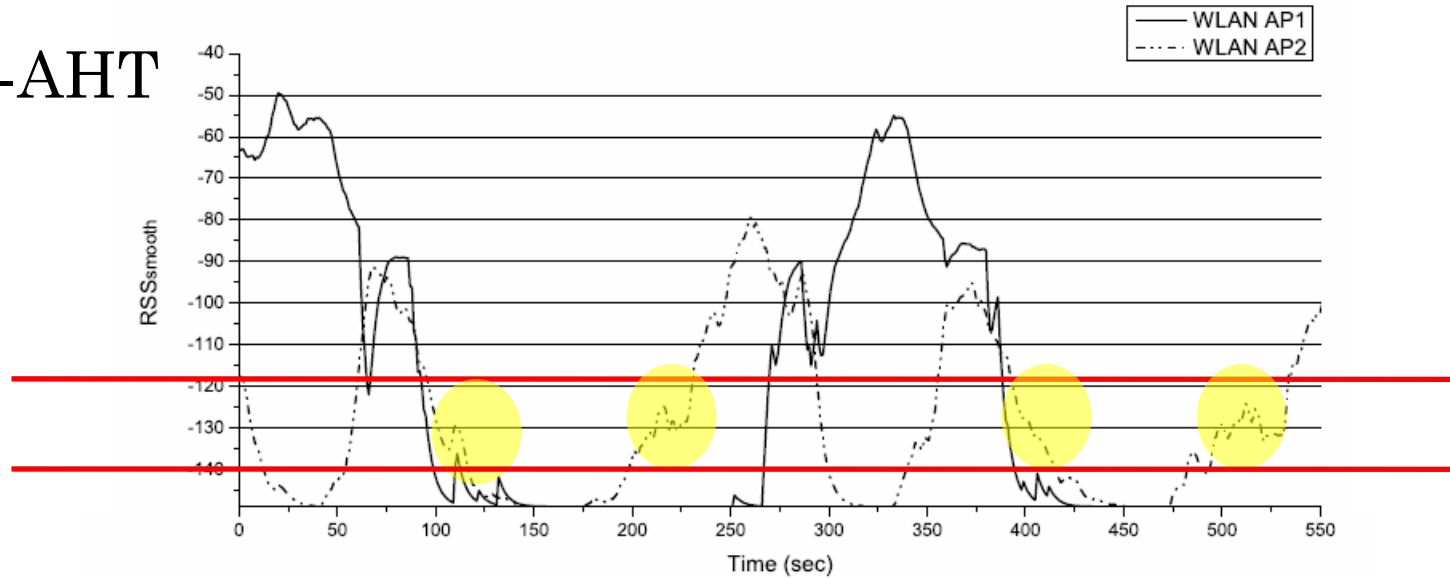
PERFORMANCE EVALUATION (2/4)

○ RSS-HT



PERFORMANCE EVALUATION (3/4)

○ RSS-AHT



PERFORMANCE EVALUATION (4/4)

○ Performance Comparison

Handoff Algorithms	Parameters			Average Throughput(Kbps)	Number of Handoffs	Packet Loss Rate(%)
	Threshold	Hysteresis	λ			
RSS-T	-130	-	-	500	19	3.41(%)
RSS-HT	-120,-140	20	-	439	6	5.99(%)
RSS-AHT	-130	10	50	535	8	3.69(%)

Maximum

RSS-T < RSS-AHT < RSS-HT



CONCLUSION

- This paper proposed a novel vertical handoff mechanism based on the RSS-oriented concept.
- The RSS with adaptive hysteresis can determine which access network is the next attached subnet.
- The proposed system utilizes the Session Initiation Protocol (SIP) and the Session Description Protocol (SDP) for handoff control signaling and adopts the MPEG-4 Fine Granularity Scalability (FGS) for stream adaptation during the handoff operation.

