

Efficient Mobility Management for Vertical Handoff between WWAN and WLAN

***Qian Zhang, Chuanxiong Guo,
Zihua Guo, and Wenwu Zhu,
Wireless and Networking Group
Microsoft Research Asia***

IEEE Communications Magazine

Speaker : Qijin Chen



Outline

- **Introduction**
- **Related Work**
- **Connection Manager**
- **Virtual Connectivity Manager**
- **Performance Evaluation**
- **Conclusions**

Introduction

- Today, the natural trend is to utilize :
 - High-bandwidth WLANs in hotspots
 - Such as IEEE 802.11
 - And switch to WWANs
 - Such as GPRS, 3G
- Vertical handoff is necessary

Related Work (1/3)

- There are many research focus on horizontal handoff
 - Switch between BSs or APs in the homogeneous wireless system
 - Limitation
 - Cannot be triggered by signal decay of the current system
 - There is no comparable signal strength

Related Work (2/3)

- Therefore, several vertical handoff decision has been made
- Mobile IP is the most widely studied approach
 - Disadvantage :
 - Lower performance
 - Hard to deployment path

Related Work (3/3)

- End-to-end solutions such as Migrate have been proposed
- Two major limitations :
 - The mobility is not transparent to applications
 - Cannot maintain user connections under several cases
 - Hosts move simultaneously
 - Host is behind NAT

Connection Manager (1/5)

- This paper propose a completely IP-centric approach
 - Connection manager (CM)
 - Intelligently detect the conditions of the different types of networks
 - Virtual connectivity manager (VC)
 - Maintain connection's continuity using an end-to-end argument

Connection Manager (2/5)

- Two handoff scenarios :
- Handoff from WWAN to WLAN
 - Physical layer sensing
 - Used to detect the availability of the stable WLAN signal
 - MAC layer sensing
 - Used to detect the network conditions of the WLAN system
 - Such as access delay and available bandwidth
 - Listen and collect the NAV

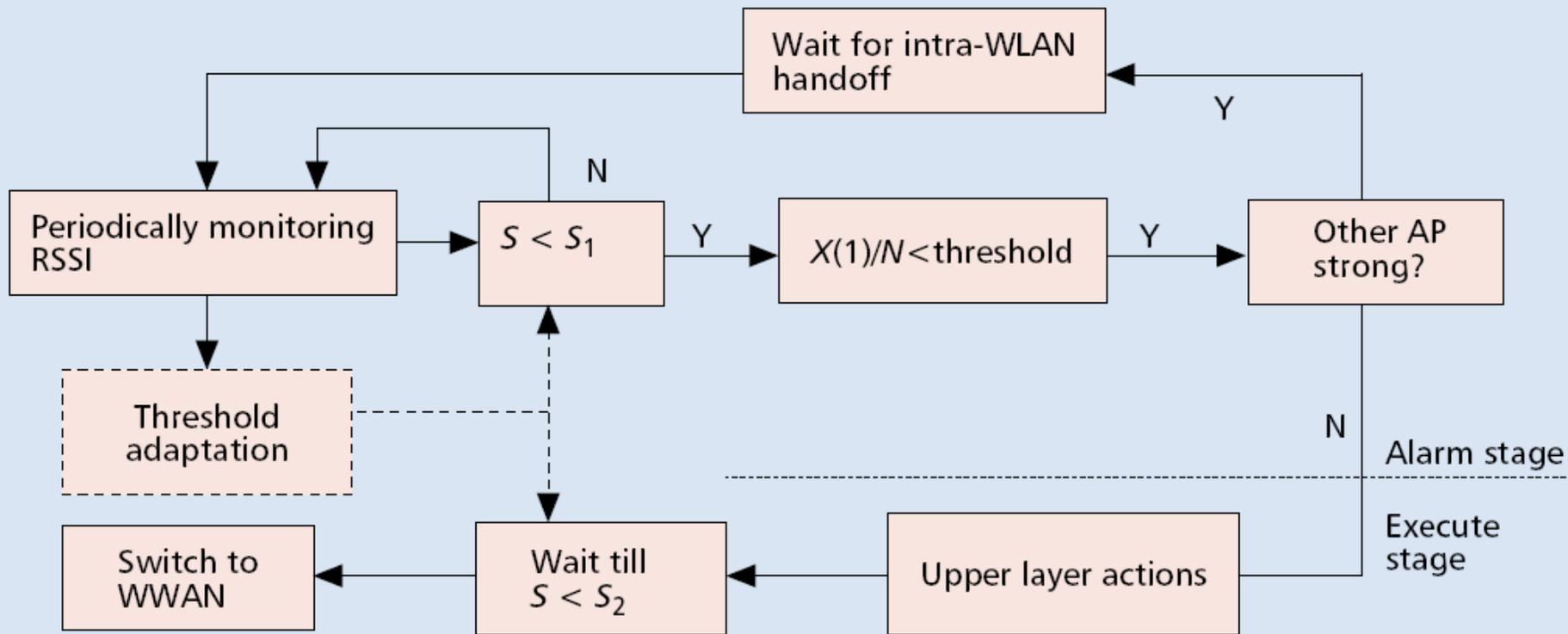
Connection Manager (3/5)

- Handoff from WLAN to WWAN
 - There are two key issues
 - How to accurately detect the signal decay
 - A great deal of variation in the sampled RSSI
 - How to determine if the signal is weak
 - Different manufacturers
 - Solution
 - Using FFT fundamental to smooth the RSSI
 - Adaptive threshold configuration

Connection Manager (4/5)

- Adaptive Threshold Configuration
 - Step 1. Record the current RSSI is valid
 - Step 2. If the sampled RSSI < S2 for some duration (e.g., 1 s)
 - Update S2 with the maximum RSSI within this time duration
 - Set $S1 = S2 + \Delta$

Connection Manager (5/5)

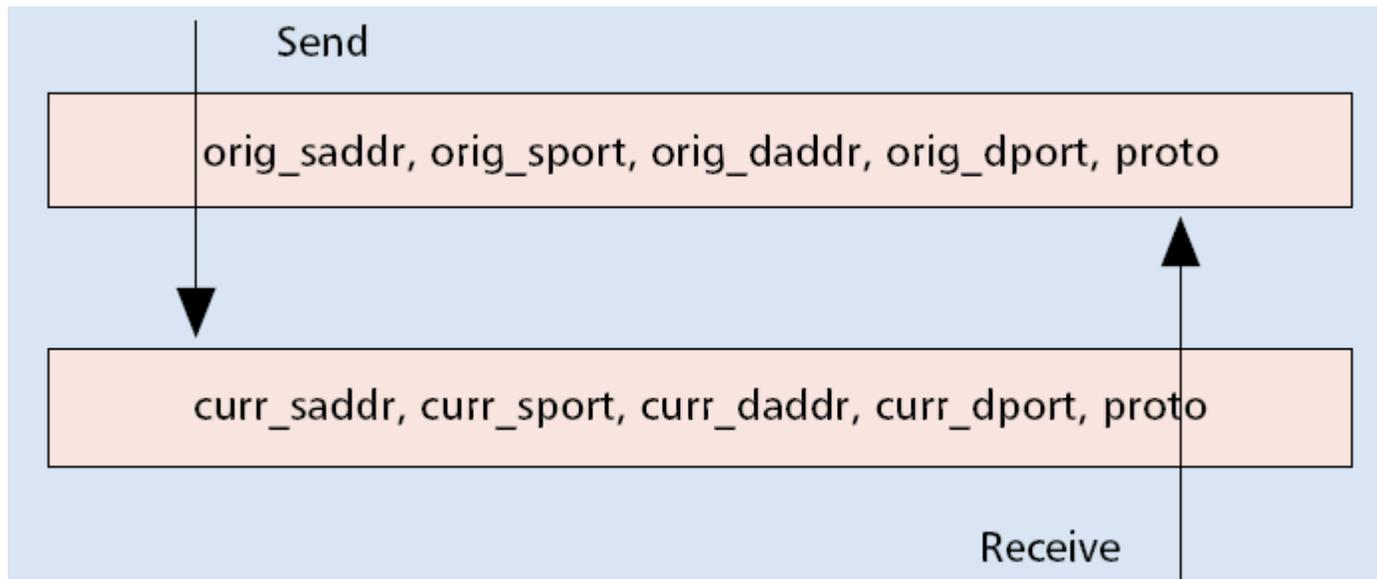


Virtual Connectivity Manager

- In order to address the aforementioned problems faced by end-to-end schemes:
 - Local connection translation (LCT)
 - Maintains a mapping relationship between
 - Original connection information
 - Current connection information
 - A subscription/notification (S/N) service
 - Provides a bridge between two communicating parties

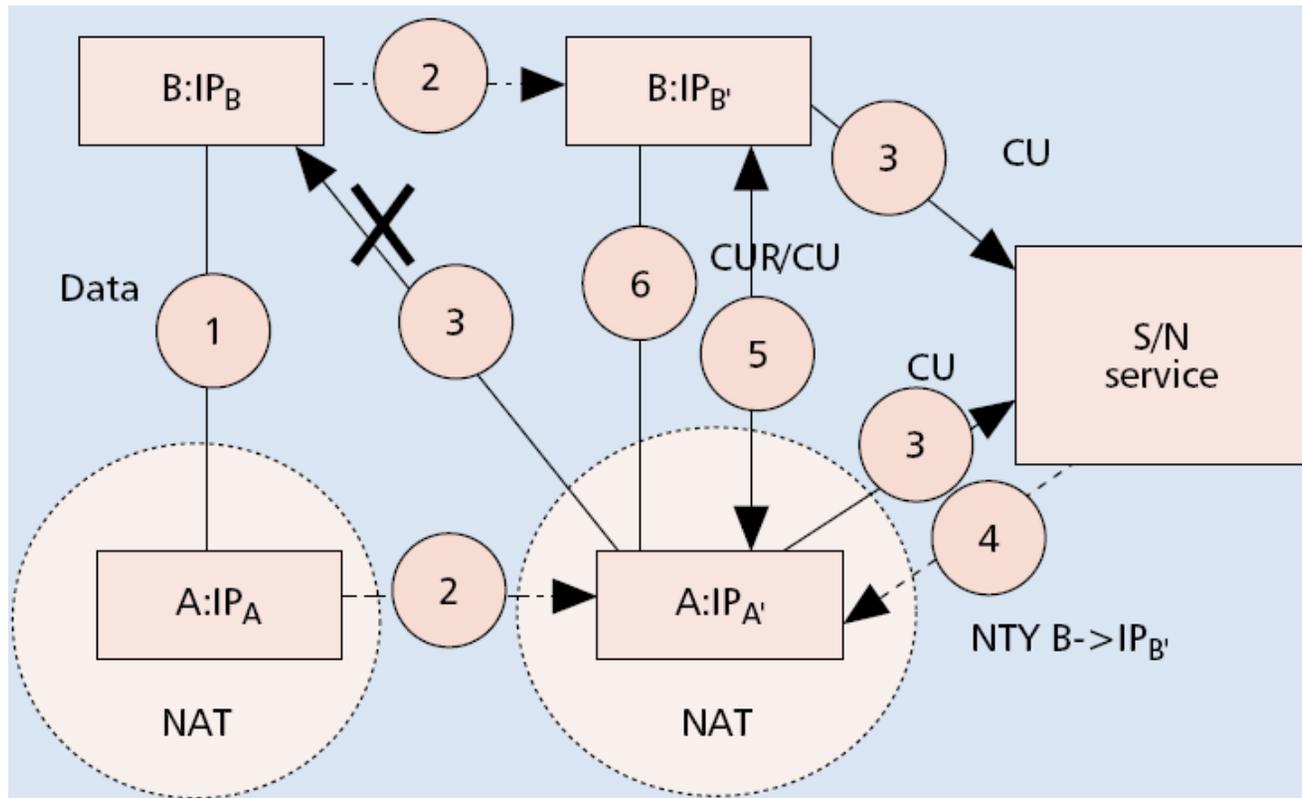
Virtual Connectivity Manager

- LCT



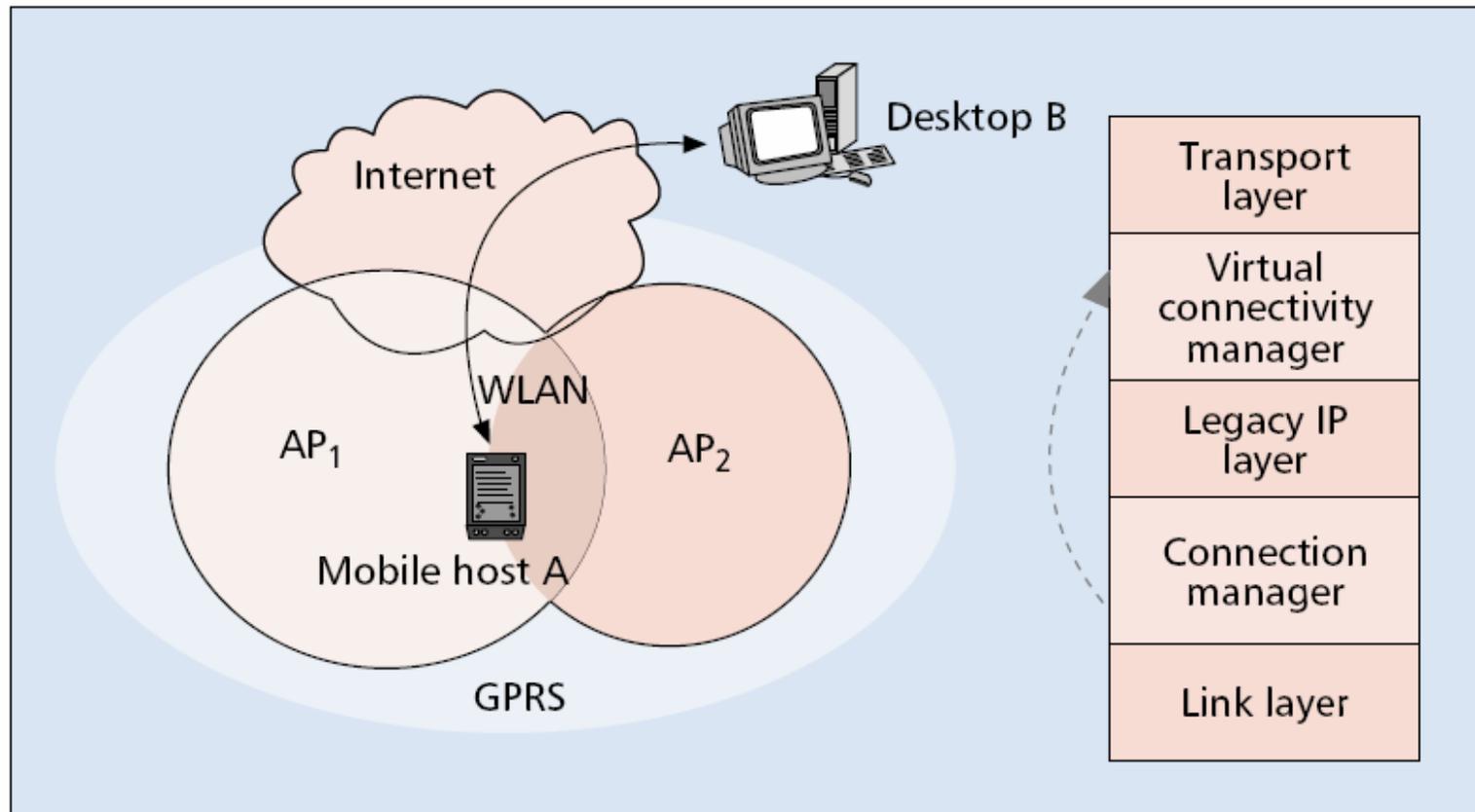
Virtual Connectivity Manager

- S/N service

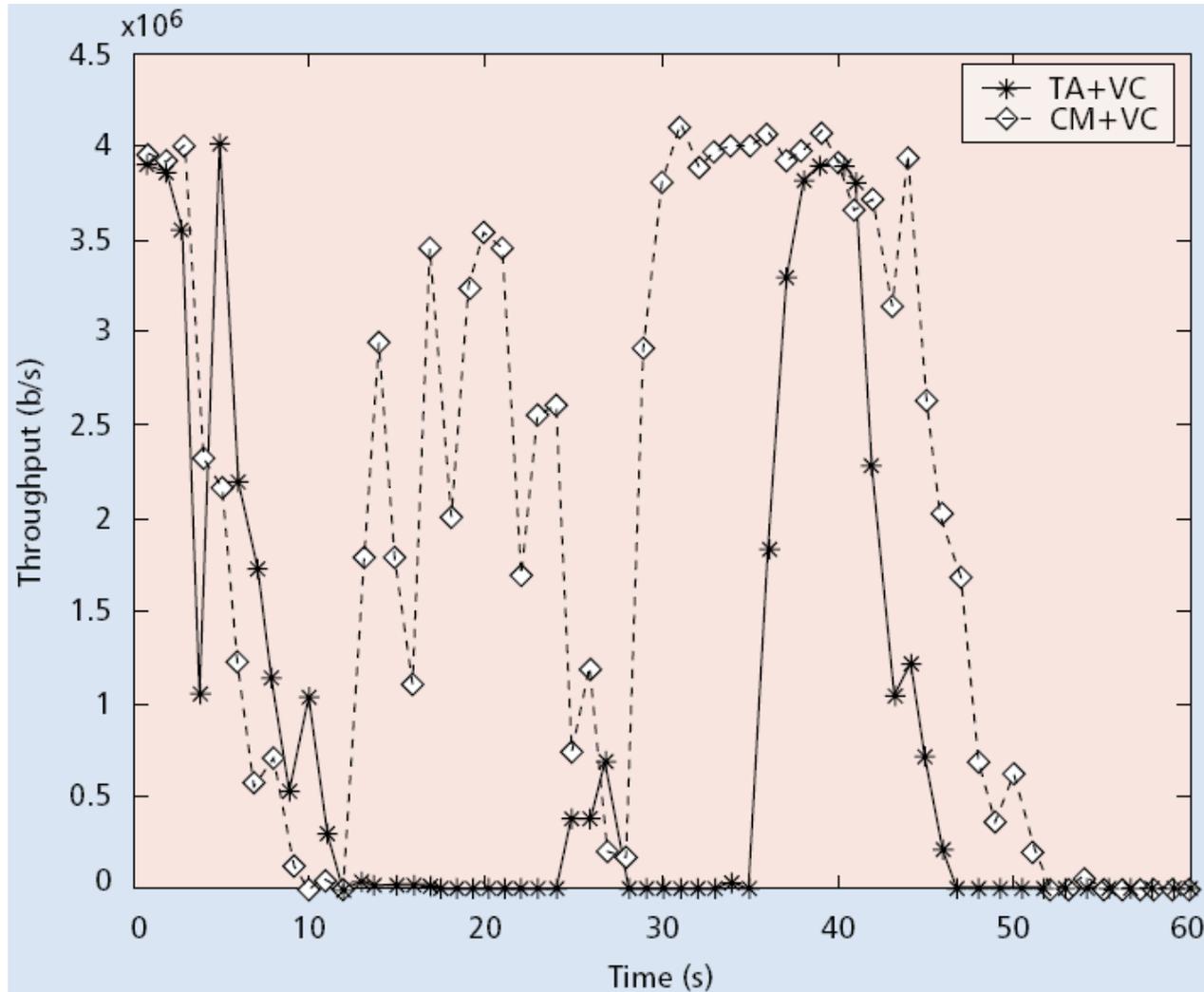


Performance Evaluation

- Network setup of the experiment



Performance Evaluation



Conclusions

- In this article a novel mobility management system is proposed
- The system integrates
 - *A connection manager*
 - Intelligently detects the wireless network changes
 - *A virtual connectivity manager*
 - Maintains connectivity using the end-to-end principle.
- This system demonstrates
 - Seamless roaming between WWAN and WLAN can be achieved
 - Much higher throughput than traditional scheme