

# Efficient Mobility Management for Vertical Handoff between WWAN and WLAN

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# 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



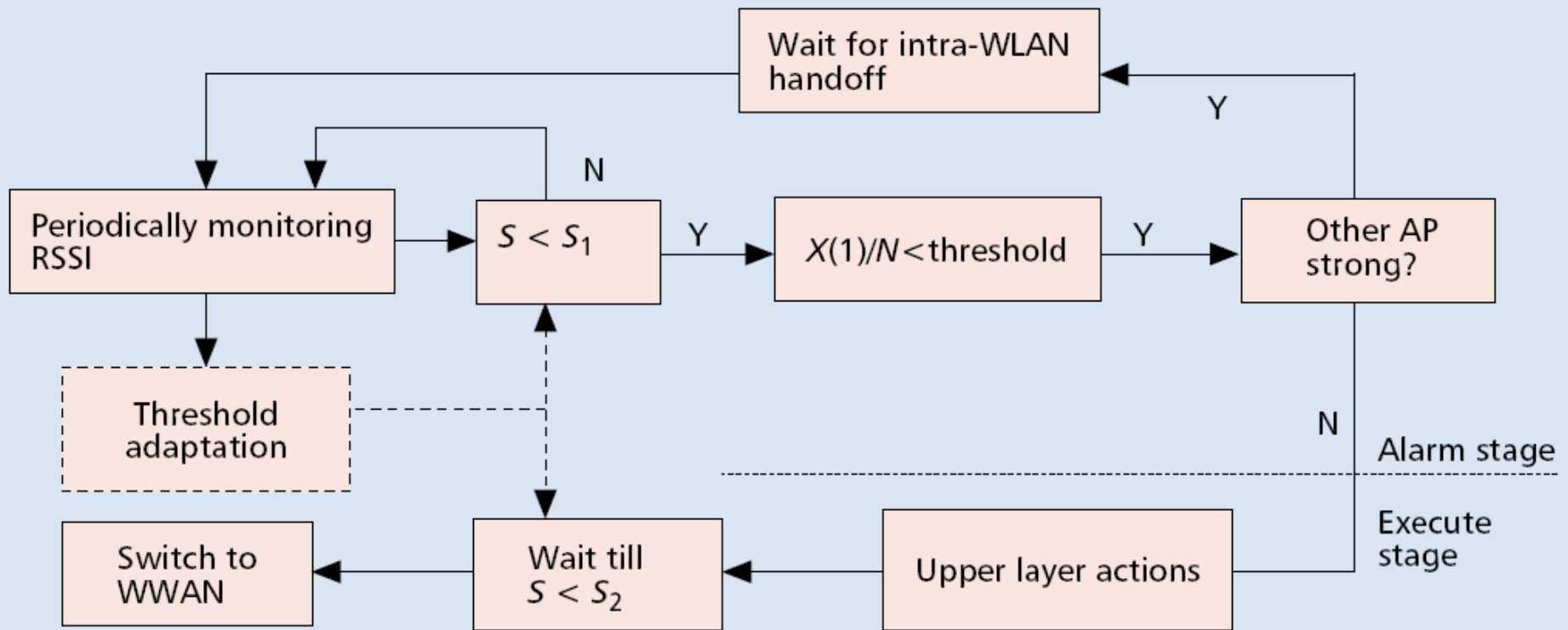
# Connection Manager (3/5)

- 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)

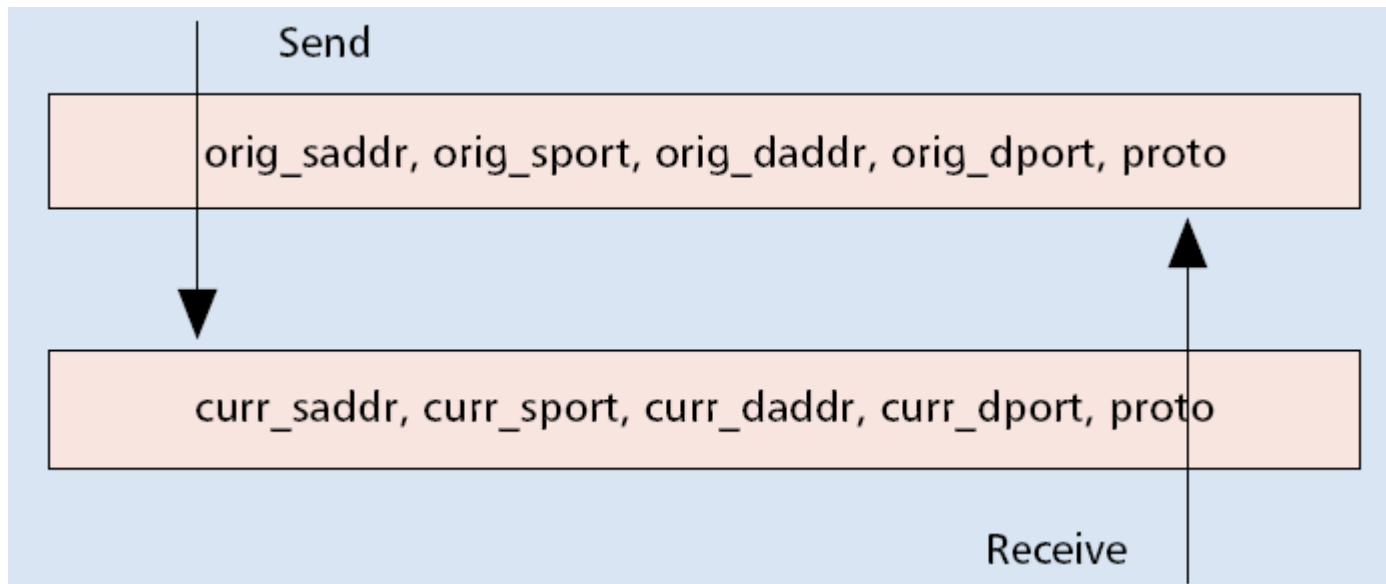


# Virtual Connectivity Manager

- 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

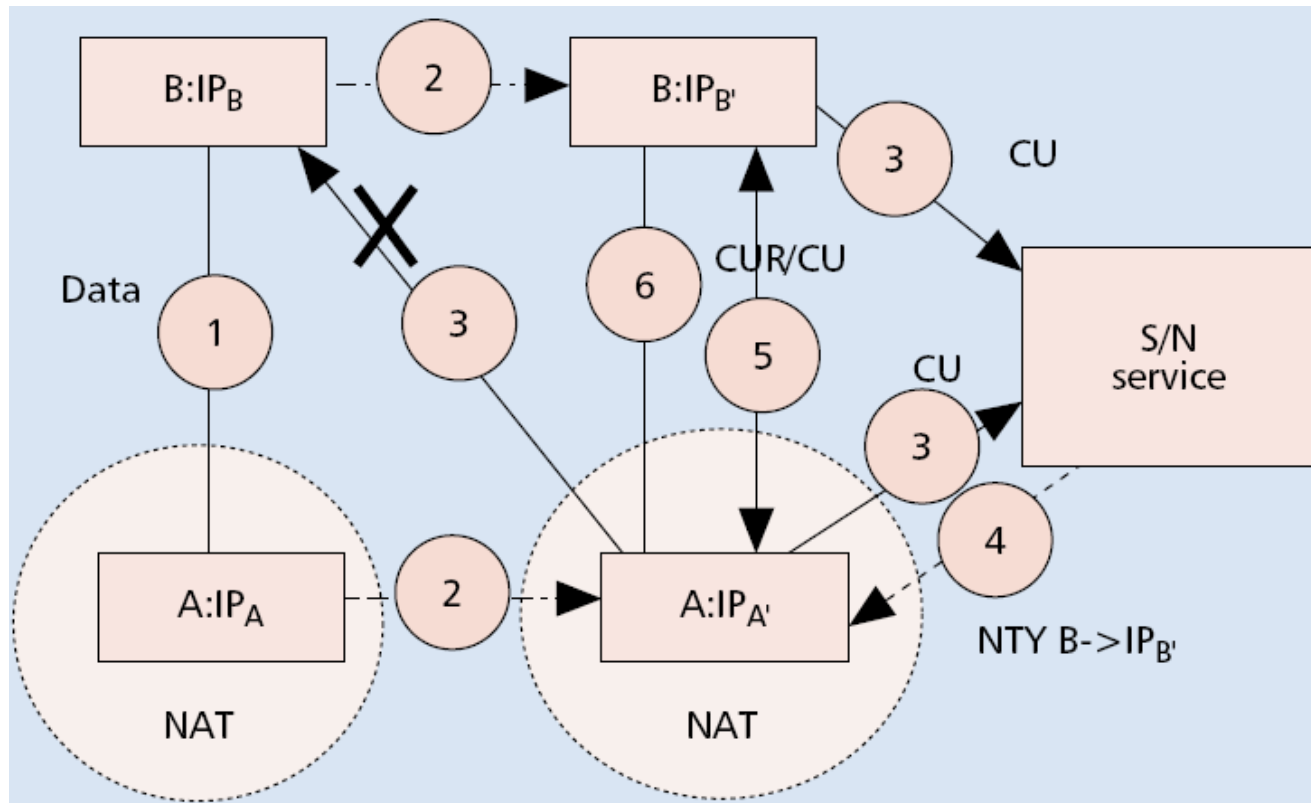
# Virtual Connectivity Manager

- LCT



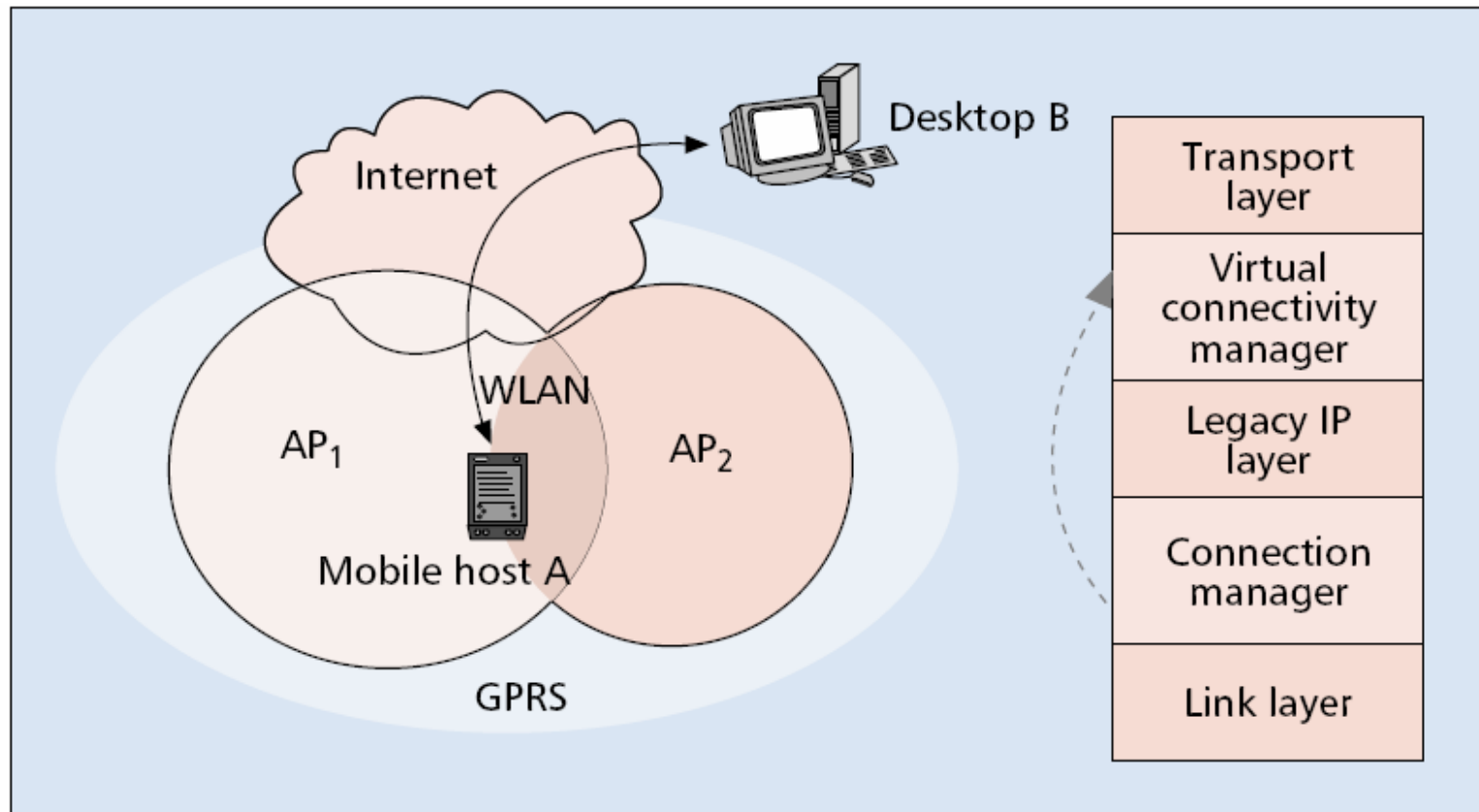
# Virtual Connectivity Manager

- S/N service

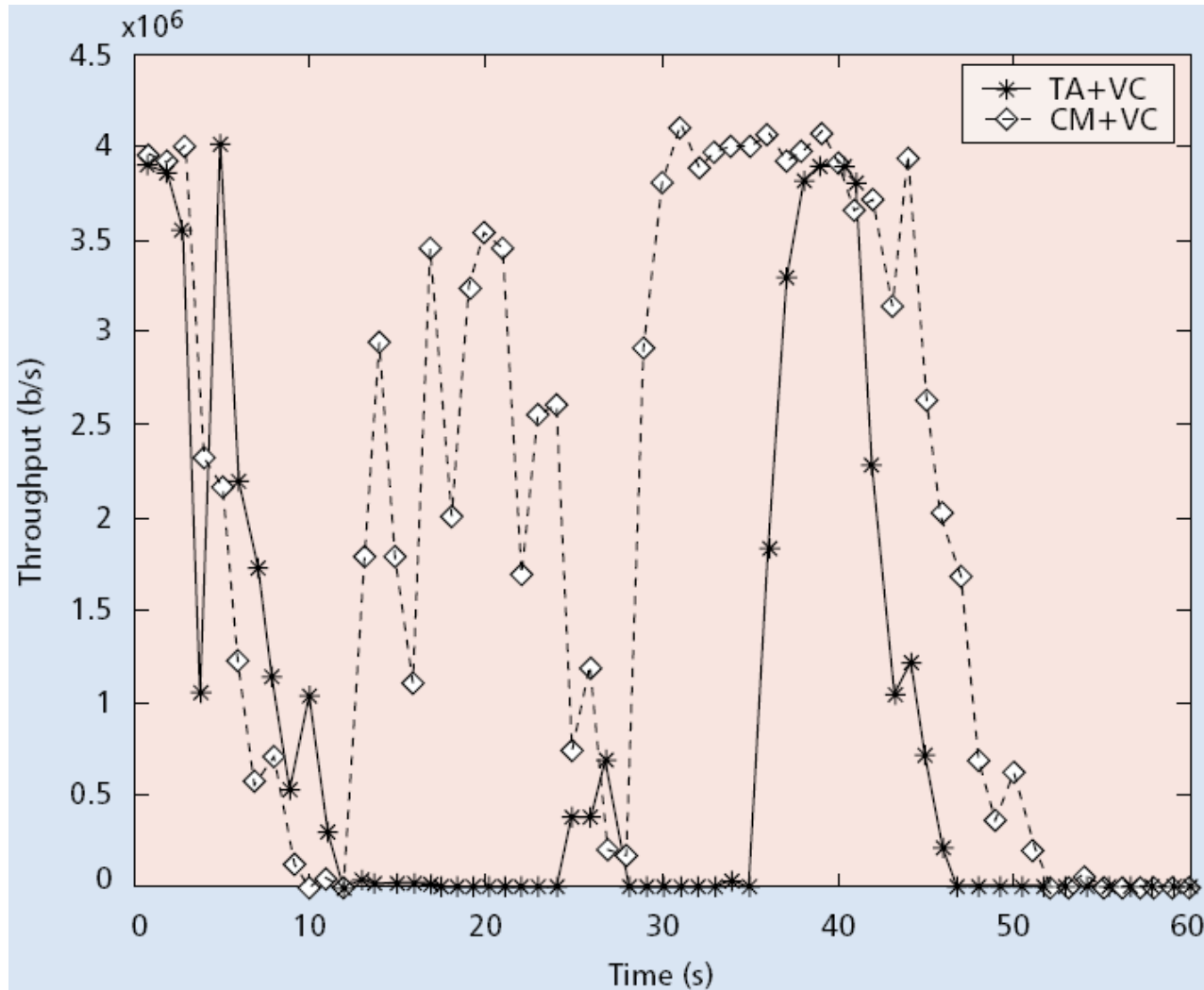


# Performance Evaluation

- 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