

## Handoff-Free Wireless Network Architecture

HKUST | Reference: TTC.PA.0777 | Jul. 2014

### Background

Internet telephony services such as Skype and Google Voice have rendered telephone networks almost obsolete. Many people have predicted the same fate for cellular networks, which, like their telephony counterparts, have complex architectures and are highly inefficient in terms of bandwidth utilisation. However, this prediction has so far failed to materialise, because IP-based mobile solutions, such as mobile IP, cannot support the seamless handoffs offered by cellular networks.

A case in point is Wi-Fi networking. Wi-Fi networks have a per user capacity 10 to 50 times greater than that of cellular networks, but at less than 1% of the infrastructure cost. Studies have shown that Wi-Fi's physical layer can support mobile users at a speed of 50 to 60 km/sec. However, no existing network architecture can support the handoff requirement (one handoff every 10 sec) resulting from the limited transmission range – only a few hundred meters in an outdoor area – of a WiFi device.

### Technology Overview

This invention is a methodology for creating a wireless network for cellphone communication whereby roaming mobile nodes (MNs) communicate through an IP-based network. There is no need for the MNs to execute conventional handoffs, which can be time-consuming and result in inefficient bandwidth usage; instead, the network's access routers (ARs) and MNs form a single-hop layer-3 ad hoc network using a thin wireless access layer constructed on top of the Internet. These ARs are sources of Wi-Fi signals, which can provide a per user capacity 10 to 50 times greater than that of a cellular network at a fraction of the setup cost. As the network uses existing ARs, no additional infrastructure is needed beyond a local registration server.

### Market Analysis

To date, only this invention has completely phased out cellular networks. However, a number of products and architectures are currently available for integrating Wi-Fi into mobile networks and allowing cellular networks to offload traffic into WLAN networks, which are much more receptive. Systems that integrate networks are competitive in that they enhance the functioning of cellular networks, which may in turn improve the overall functioning of the networks and devices and thus reduce the perceived need for an entirely new network.

The importance of this invention will become more obvious in the future 6G network, which uses a much higher frequency band than used by 5G. This means a much shorter transmission range and a much smaller cells. As a result, the traditional handoff problem will be difficult to solve. But this problem can be easily tackled with the architecture described in this invention.

## Benefits

- Significantly reduces the cost and bandwidth traffic incurred by MN communication.
- Streamlines the handoff process to make mobile IP a viable replacement for cellular networks.
- Reduces the cost of implementation relative to cellular networks.
- Significantly increases the user capacity.

## Applications

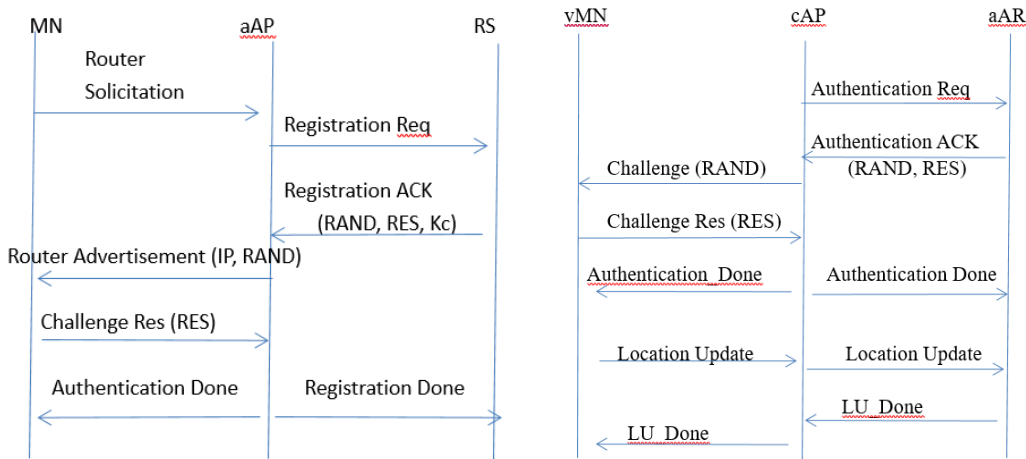
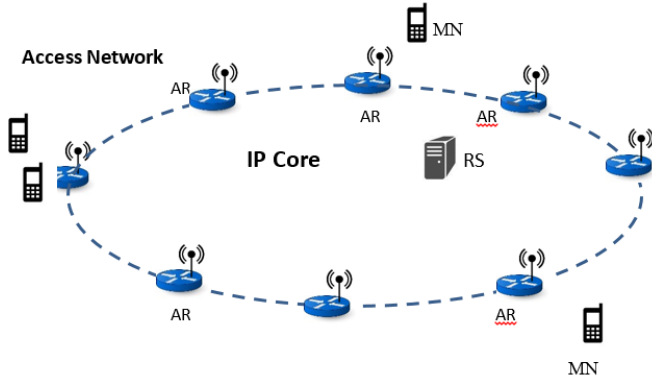
- Wi-Fi based IP telephony application for high speed mobility environment
- Wireless network infrastructure enhancement

## Patents

- US Patent no.: 9,913,092
- China Patent Pending: 201580029474.1

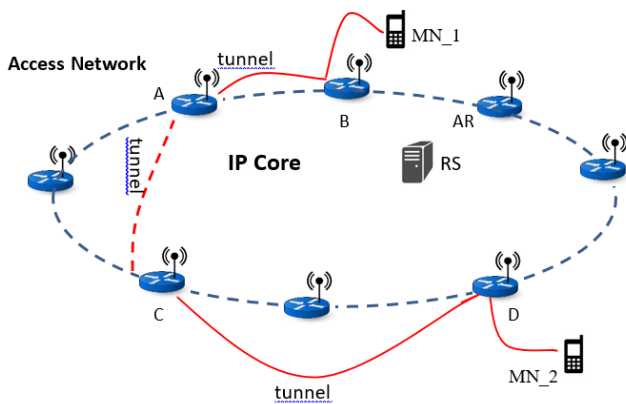
# Figures

AR: access router  
 MN: mobile node  
 RS: Registration Server



Dynamic anchoring of an MN

Authentication of a roaming MN



Three tunnels are constructed for data transmission in the IP core network.