CHAPTER 6

CONCLUSION

6.1 GENERAL

Real-time applications such as video conferencing and voice application on wireless networks have increased the need for guaranteed finite delays and dedicated bandwidth. There is a need for transparent QoS for users. Even though existing methods provide QoS, there is a need for better utilization of available bandwidth and QoS guarantees for end user. The existing proposals for QoS guarantee over wireless networks are analyzed and the strengths, weaknesses, and solutions are identified. Some examples of the weaknesses are separating the call admission control from bandwidth reservation scheme, inability to adapt to network fluctuation resources, and the lack of mechanism that reserves the resources in a static manner based on mobility.

6.2 RESEARCH CONTRIBUTION

This research has provided the following solutions, which are modelled to analyze and provide effective network utilization and mobility management.

- Enhanced Active Channel Scanning Protocol (EACS)
- Dynamic Call Admission Control (DCAC)
- Dynamic Resource Management Framework (DRMF)
- Route Optimization in Mobile IP (RMIP)
The proposed protocol and model are realized in the AP firmware and the performance is analyzed using Ns2.

6.2.1 Enhanced Active Channel Scanning (EACS) Protocol

The mobility management is one of the most critical issues in wireless networks. Deployment of VoIP and other real-time streaming applications has been limited in WLANs today, partially because of the high hand-off latencies experienced by mobile users.

The layer-2 hand-off latency is minimized with the help of proposed EACS protocol along with the pre-hand-off initiation algorithm. The proposed zone layout and RSS based threshold value enable MC to perform hand-off process well in advance compared to the conventional hand-off process. The proposed pre-hand off initiation algorithm and channel scanning table are incorporated in the AP firmware. This enables the MC to perform educated decision making during hand-off process. Incorporating dynamic channel scanning table in AP and AR eliminates the hard channel scanning process.

The proposed mechanism is compared with the conventional layer-2 hand-off process in standard MIP as well as in MIPv6. The hand-off latency is reduced from 310 to 33ms. The minimized latency is more suitable for real-time VoIP applications. The throughput in the overlaid area is much better in the proposed EACS protocol. In fact, 51.6% throughput is increased in the proposed method. The experimental and simulation results show that the hand-off mechanism allows a network operator to significantly reduce the impact of hand-off and data flow for real-time applications.
Pre-hand-off initiation signaling mechanism provides educated decision making instead of blind hand-off decision-making policy. The threshold based hand-off mechanism satisfies the QoS requirement. The pre-hand-off initiation mechanism is useful in the incoming 4G vertical hand-off. The EACS protocol provides automatic and dynamic hand-off mechanisms with less packet loss for real-time applications.

6.2.2 Dynamic Call Admission Control (DCAC)

An adaptive multimedia paradigm plays an important role in mitigating the highly fluctuating availability of bandwidth resources in wireless networks. The proposed DCAC framework and mathematical model for wireless network have been presented. The proposed framework considers multiple classes of multimedia services with different QoS requirements. In this framework the important components are application profile collectors, location monitoring unit and QoS based DCAC algorithm for adaptive resource provisioning.

The simulation results show that the hand-off call dropping probability is always lower than the new call blocking probability. The non-real time application blocking probability is lower in static CAC method when compared to the proposed DCAC method. The utilization of network resources by DCAC is 34% more than that of static CAC. In the static reservation method, it accommodates 66.67% of the real-time calls and the remaining calls are blocked. The proposed DCAC works well with the existing standard WLANs.
6.2.3 Dynamic Resource Management Framework (DRMF)

The proposed load sharing mechanism based on the capacity of APs in campus wide WLAN is evaluated. The free capacity estimation algorithm is not complicated, but provides good estimate even when the network environment changes abruptly. Each AP and AR in the campus wide network is aware of the capacity of its neighbouring APs and ARs. The enhanced active channel scanning protocol is a tool that enables such an operation. The proposed mechanism can be realized in 802.11 WLANs. Even though the load balancing mechanism is elaborated and tested in the 802.11 WLAN environments, the mechanism can be applied to other wireless packet networks as well.

The architecture maintains centralized control information about the load on each AP. The load sharing algorithm accommodates more users with minimum required QoS and improves network utilization. The simulation results show that the proposed DRM framework performs well in a variety of user configurations. Balance index is used to evaluate the utilization of the network. The performance benefit of the capacity-based load sharing mechanism is presented in terms of the traffic drop ratio. It is shown that the traffic drop ratio is decreased by more than 50% in comparison with the unconventional method.

6.2.4 Route Optimization in MIP (RMIP)

The proposed distributed WLAN architecture with RMIP for an efficient mobility management is analyzed. The simulation results are conducted for varying the speed of the mobile device. The results for various speed and the throughputs are observed for MIP and the proposed RMIP. The primary role of the EACS protocol is to provide MN and ARs with
appropriate information on neighbouring AP that can be used in hand-off target AP selection. It is a complementary protocol to Mobile IP and other mobility management protocols. The EACS protocol requires that each AR knows the IP address of the neighbouring ARs and the Layer address of the neighbouring AP. The hand-off based discovery mechanism allows distributed and dynamic discovery in a scalable manner. The throughput is increased by 25.93% in RMIP than MIP. The packet drop ratio is reduced in RMIP to support real-time applications with minimum latency time.

6.3 FUTURE RESEARCH DIRECTIONS

This section describes several additional research issues that are related to performance enhancement in heterogeneous systems, which require further investigation. It is expected that the number of Voice over WLAN (VoWLAN) handsets will increase rapidly. Broadcom has introduced a chipset solution for the development of a wireless VoIP handset that will support voice and data applications (web browsing, email, and instant messaging) within an 802.11g WLAN environment. The chips include integrated support for advanced security and QoS.

It is also predicted that future mobile devices will support multiple wireless standards (Chevillat and Schott 2002). An obvious heterogeneous combination is 3G and WLAN. The main benefit of a 3G/WLAN device is the increased data communication capacity when accessing a WLAN. Market analysts have indicated that worldwide by 2009, roughly 30% of all cellular voice devices will have some type of WLAN, and roughly 18% of cellular voice devices will incorporate WLAN designed to carry voice (Ulseth and Engelstad 2006).
The important elements for heterogeneous mobility management are:

- Hand-off latency minimization in heterogeneous network.
- Dynamic call admission control model for heterogeneous and MEMO network.
- Resource sharing among WLAN, Cellular and adhoc network.
- WLAN QoS availability and the adaptation of the WLAN technology in voice applications.
- Available security and access control mechanisms for heterogeneous networks.
- Available handsets at an affordable price.
- Usability aspects.

The usability is linked to security solutions and how an acceptable QoS is obtained. Mobility is assessed as one of the key drivers. By providing VoWLAN technology to health-care workers, for example, hospitals can improve the productivity of doctors and nurses, ensuring they spend time with patients instead of running to retrieve messages. Other market segments that have been highlighted are education, manufacturing plants and retail stores. A common aspect of these market segments is the mobility of the staff. Analysts predict an exponential growth of VoWLAN devices in the next ten years. A factor that may influence the growth is the services offered by mobile operators to enterprises. To conclude, VoWLAN as a supplement to the fixed network VoIP installation will be a success in the residential market.
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