Dynamic Bandwidth Aggregation in Heterogeneous Wireless Networks for Mission Critical Applications

The project was to develop a software based product to be used for bandwidth aggregation as per required quality of the service (QoS). It developed a system that, using the available wireless and wired network interfaces, provides a dynamically aggregated bandwidth which can be used to offer services requiring sustainable data rates, redundancy, and real time performance.

This research activity resulted in the development of a system to monitor network-centric and application centric QoS parameters and maximize QoS provision by utilizing network resources optimally. Following is a summary of the major steps in this research and development activity.

1. Study of heterogeneous network environment as a tool for maximizing QoS, within the constraints of maximizing network resource utilization with capacity aggregation and increasing operating space for QoS parameters like end-to-end (E2E) delay bounds, E2E delay variation and capacity estimation.

2. Modeling of end-to-end QoS provisioning in heterogeneous wireless networks for critical applications.

3. A suitable solution (developed an algorithm) that maximizes QoS provisioning with resource utilization constraint. Simulations of the algorithm for optimizations.

4. Implementation of the developed algorithm as software modules termed as Bandwidth Aggregation Router (BAR).

5. Usability of the Bandwidth Aggregation Router for a real time interactive distance service (distance education).

The system, BAR, performs four main tasks to provide the said services:

1. Diverse network interface support, including the currently available network interfaces like GRPS, EDGE, EV-DO, WiMAX, DSL, and Dialup Modems.

2. Dynamic estimation of uplink and downlink bandwidth and delay.

3. Get receiver's capabilities, e.g buffer sizes etc.

4. Distribute the traffic generated by the application according to the currently estimated bandwidth for each link.

Results achieved

Project focus was to increase the throughput for three main protocols TCP, UDP and ICMP. Significant throughput gain is achieved for the above mentioned protocols. For the TCP approximately 94% increase in throughput has been observed when two interfaces were used with DBAR, which is expected to further increase when more than two interfaces are used. For UDP approximately 62% increase in throughput has been achieved when two interfaces were used with DBAR, as compared to throughput achieved when single interface was used. This is expected to increase when more than two interfaces are used with DBAR.