Marriage of wired and wireless networks to build tomorrow's internet

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ABSTRACT

Tomorrow's internet will neither be completely wired nor be completely wireless. Advantage of wired network is its vastness of bandwidth due to the use of optical fiber, cable etc. Every house in future will be connected by video-cables using optical fibers. But wired network has strictly static configuration not allowing connection while roaming. Wireless technique is an obvious choice in staying connected while in transition. The most obvious example of this is cellular phone - though today still now on the audio capable only. Our focus is to investigate although currently available cellular phones are audio capable only, how video compatible cellular phone can be designed. Bandwidth rich video, if to be supported by all phones, will severely restrict the total number of users simply because not much bandwidth is available in RF media (e.g., consider a system with 10,000 nodes each requiring 2 Mbps compressed video links). FCC regulations do not permit development of wireless LANs involving such wide bandwidth of frequency usage. This will hurt the scalability attribute of the design. What can we do?

Our proposed solution is the interim of the wired and wireless network. Where roaming nodes when they reach near a wired site are automatically connected back to the wired media. The idea is to utilize the large bandwidth infrastructure available over the wired backbone network to connect all static nodes and at the same time use the wireless (i.e., RF) media for only those nodes which are in transition from one wired site to another. As a result, majority of the users, who are in close proximity to a wired site will connect themselves over the wired media. This will release the RF media from extensive bandwidth loads. On the other side, any one of those static users can suddenly desire to roam around, and if so they can unplug their wire connections - and they will be automatically handed over to the wireless media.

Now internet can be considered as a collection of heterogeneous networks where some are wired and some are wireless. A node will be assigned to any of these two classes depending on which is more advantageous from the bandwidth point of view. This solution approach leads to several research issues. During automatic handover from wired to wireless media there must be a deadline bound scheduling mechanism to dynamically request and reserve wireless channel. A reverse mechanism to handover from wireless to wired media must deal with synchronization between RF bit-stream and wired bit-stream. Users should be reminded if they roam for a long time or reach near a wired backbone. Automatic inter-cell routing must be dynamically invoked. To reduce the bandwidth loads of the video or multimedia, enhanced or domain-specific image compression techniques (e.g., iconified video) should be researched. Security is also a critical issue that becomes important as users move from site to site, and expect to find their network services - yet prevent unauthorized access. There are clear distinctions between wired and wireless network, each has some advantages over the other and one can not purely compensate the other. So, it is unclear as to which network can win over the other in future. But, the eventual winner must be an intermix of wired and wireless. The question is how optimally we can join them together - and our current research is based upon this.

1 supported by a grant from honeywell Inc.