Mobility: Challenges and Opportunities

Luiz Claudio Schara Magalhães, PhD

Depto de Eng. de Telecomunicações – Universidade Federal Fluminense (UFF)
Rua Passo da Pátria 156 – 24220-121 – Niterói – RJ – Brazil
schara@midiacom.uff.br

Abstract. *This presentation focuses on two main ideas: that mobile devices should be mobility-aware, and that hiperconectivity (increasing the number of paths at the edge of the Internet by creating large "cooperative" networks) is a way of creating resiliency in the increasingly vital resource which is Internet access.*

When the Internet was created, the type of mobile devices we have now were virtually unknown. In fact, all computers connected to the network were mainframes with rare exceptions. Therefore, tying together identification and routing in a single identifier made sense. When mobility was introduced, the solution chosen to support it was to hide mobility. Mobile-IP maintains a home network as the canonical address of the mobile host, and mobility is achieved by tunneling from this home network to the real position of the mobile. Although this allows traditional applications to be used without change, this makes mobile devices second class citizens of the Internet. Their routing will be necessarily more inefficient than their fixed counterparts, and the devices are not able to take advantage of their adaptability.

As Internet access becomes ubiquitous, being used in all public and private instances of life, it is imperative to guarantee that services will not fail when a link fail. Moreover, the loosely hierarchical architecture of the Internet, which was a result of interconnecting autonomous networks, becomes strained when networks lose their communal aspect. When the Internet was created by connecting research and University networks, the individual networks had users which had great affinity, and traffic was in part internal. In contrast, current commercial providers create groupings that are random, and traffic tends to be extra network, generating topologically inefficient routing depending on the peering between networks.

Mobile devices generally have multiple network interfaces. For example, the well know Nokia N95 cell phone has five radios and seven antennas, plus both an USB and an infrared port. This allows a N95 to have simultaneous infrared, wifi, Bluetooth and 3G links. Alas, normal IP routing will only allow one of these interfaces to be used at a time. An aggregate link, made up of all available physical links will greatly improve throughput and resiliency of communication. If a mobile host can change the set of links being used at any time, mobility can be achieved simply by trading a failing link with a new one that becomes available.

Hiperconnectivity helps link availability by creating a framework where cooperative networks can be created. Instead of postulating the connection to a central provider, the idea is to create networks interconnecting physical neighbors. The link technology to do that is already available, and mesh networks are one instance of that technique. Another example is the community network called REDECOMEP in Brazil, where dark fiber is launched to interconnect research institutions and Universities, as well as municipal and state institutions. To create a higher degree of interconnection at the edges allows for alternative paths in case of failure, and for better routing of local traffic. There are many research and even business opportunities for cooperative networks, and it is a great solution for providing good, high bandwidth connection at low cost for better last mile capillarity.

Hiperconnectivity creates an environment with many opportunities for network access, which can be explored by mobile hosts, especially if they are able to use well connectivity-rich environments. This provides fertile ground for new applications, which can take advantage of local, low cost connectivity as well as location information to provide new services for mobile hosts.

References

Carrano, R et al, Multihop MAC: IEEE 802.11s Wireless Mesh Networks, Encyclopedia on Ad Hoc and Ubiquituous Computing, 2009

Magalhães, L, A Transport Layer Approach to Host Mobility, PhD Dissertation, 2002

Biography

Luiz Claudio Schara Magalhães has a PhD in Computer Science from the University of Illinois at Urbana-Champaign. He has been a professor at the Telecommunications Department at Universidade Federal Fluminense since 1994, instructor at UIUC, Visiting Scholar at HP-Labs in Palo Alto and is currently working for the Brazilian government on the deployment of mesh-network capable educational laptops. His main research interests lie in the area of mobility, large scale infrastructure to support mobile nodes, hiperconnectivity (high-redundancy last mile access) and device environment awareness and cooperation.