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Layer 7 Multimedia Proxy Handoff Using Anycast/Multicast in Mobile Networks

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In the modern life, everyone may have at least one kind of mobile and IT products, e.g., mobile phones, PDAs, notebooks or MP3 players. In order to satisfy users' requirements, the popular distribution of 3C products not only stimulates to advance the hardware computing capability, but also considers whether the product appearance and design meets fashion trends or not. In addition, as the growth of wireless/ mobile communications, it is a trend to let new-generation portable devices possess more than one wireless access capability. For example, dual-mode mobile phones can make a connection through Wireless LAN or GSM/GRPS/3G.. Users can request various network application services from the Internet anytime at anywhere using the most suitable connection.

Proxies are widespread to apply network application services, such as WWW or Multimedia Streaming. When a user requests a network service, a proxy would buffer the corresponding data into its cache. Once other users request the same service, the proxy can immediately response those requests using the data stored in the cache. Besides, each client may connect to the Internet via different transmission links, i.e., each connection may have different transmission qualities. A proxy server is able to transcode the cached data into different qualities of objects and then deliver each client different qualities of cached objects according to the link condition. Thus, proxy servers not only reduce the initial waiting time but also adapt the quality of cached objects to the transmission links.

Regarding proxies over the mobile network environment, mobile users can retrieve the requested data rapidly from the local cache. Even if the link stability of wireless/mobile networks are far less than those of wired networks, proxy servers can adjust the quality of cached data based on the current transmission link. However, since mobile clients possess the "keeping moving" characteristic, it is unreasonable that the mobile user always connects to the same proxy server for requesting data from the starting point to the end point. For example, a user taking train from Taichung to Tainan is watching online news. When it arrives in Tainan, based on the essence of proxy cache, it should connect to a local cache, not to the original proxy in Taichung. Thus, our work defines a new layer 7 proxy handoff mechanism, which can let mobile clients dynamically switch their proxy servers according to their transmission quality, geographical dependency, the moving path, etc.

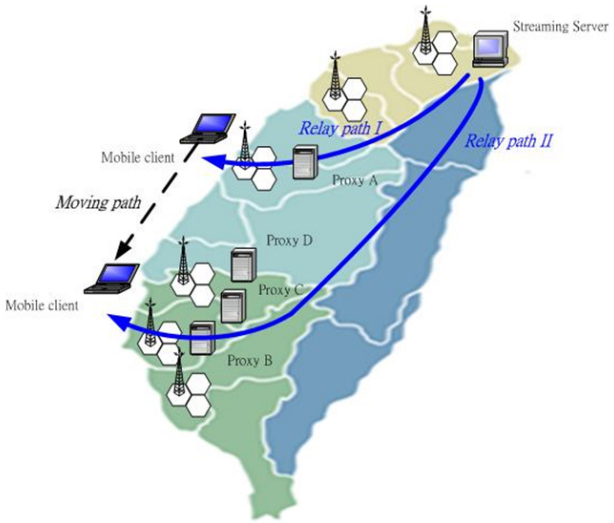

Figure 1: Scenario of Proxy Handoff

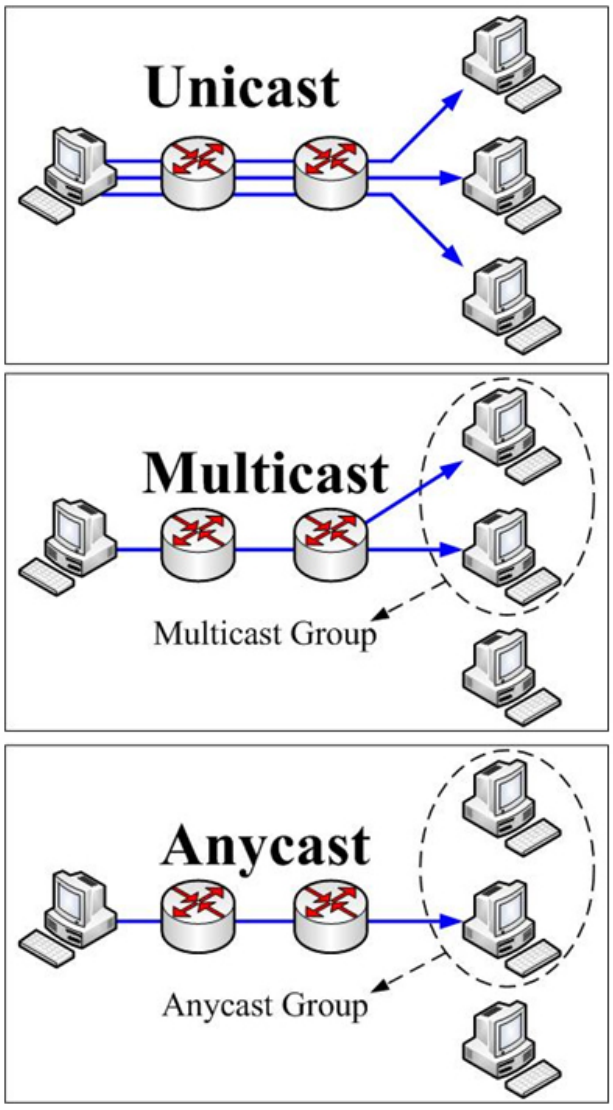

Figure 2: Unicast, Multicast and Anycast

Our work utilizes the characteristics of the next-generation Internet Protocol, i.e., Internet Protocol Version 6 (IPv6). Firstly, three transmission types defined in IPv6 are (1) unicast, (2) multicast, and (3) anycast. Unicast is the common way to establish a connection between two nodes. Each connection is established independently. Multicast delivers data to a group of destinations simultaneously. Data pass through each link only once, and create copies when the links split automatically. Anycast routes data to the nearest node of the targeted group which is made up of a set of destinations. The “nearest” meaning is the minimum hop count. Secondly, the IPv6 addressing architecture divides addresses into three categories, i.e., (1) link-local, (2) site-local and (3) global. Link-local addresses can be used in a local network and not for routing beyond the network. Site-local addresses can be used in a site. However, a site is not specified in the IPv6 standard. Global addresses can be used in any scope. Each type of addresses can be used in its corresponding scope. Once an address is beyond its scope, the address becomes invalid. Based on the above characteristics, our work defines a multicast group with a site-local multicast address. Each proxy supporting the proposed proxy handoff mechanism should listen to the pre-defined site-local multicast address. Because of the site-local address scope, each proxy can be grouped based on their located subnet. Finally, we implemented the anycasting concept in the application layer because we want to define the selection policy instead the original “nearest” selection policy of IPv6 anycast. Our policy can determine one of proxies in the same group as the most suitable proxy for each mobile client dynamically.