# Dynamic Link Striping: Breaking the WAN Bandwidth Barrier in Piconets

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Multiple communication interfaces in personal portable wireless devices are becoming more prevalent. We anticipate that these devices will often have two types of communication interfaces: a local area, short range, high bandwidth wireless network interface such as WaveLAN, Bluetooth, etc., and a wide area, long range but low bandwidth network interface such as cellular phone, richochet modem, etc. Our research investigates forming dynamic, ad hoc communities of such devices communicating with each other using their LAN interfaces. The MANET working group of the Internet Engineering Task Force (IETF) is conducting related research, focusing on the routing in mobile ad hoc networks [1, 2]. We call such ad hoc communities piconets. Each piconet member normally accesses the Internet using its WAN interface. Thus, the rate of transferring data to/from Internet is limited by the low bandwidth of the WAN interface.

We propose to break the WAN bandwidth barrier in piconets by "striping" data over each of the WAN links of several piconet devices. There are a vast number of applications of striping (i.e. sending a fraction of data over each of the several independent communication links) in disk storage systems and LAN/WAN systems. The former are generally implemented to realize higher throughput to slow disk drives [3, 4], while the latter are used to minimize costs of relatively more expensive WAN connections [5, 6, 7]. Unlike these traditional striping applications operating in a relatively static environment, we consider highly dynamic piconets where device membership changes rapidly.

We claim it is feasible to achieve a high degree of bandwidth aggregation using data striping because of the collaborative nature of piconets and the potential of statistical multiplexing on the aggregated channel. Data striping not only improves the quality of service but also enables new, otherwise impossible services, such as high quality video streaming from remote sources to devices on piconets.

Our research explores a variety of design issues and tradeoffs in creating a piconet data striping system. It is possible to implement striping at different network protocol layers depending on the target applications, types of WAN connections or location of data sources. If the membership in a piconet is highly dynamic, it might not be advisable to utilize striping for non-bandwidth-adaptive applications. Similarly, the potential for packet reordering during striping might affect some applications adversely. This research explores various design issues for a piconet data striping architecture. It tradeoffs and determines the feasibility of different design options for various piconet scenarios.

**References**

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