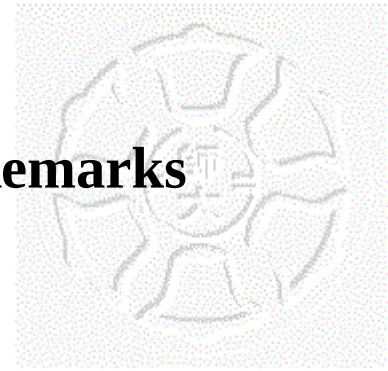
Chapter 7

Concluding Remarks



In this dissertation, we have proposed a structure called *Legion* for constructing various schemes for distributed applications. According to the different parameters and numbers of parameters employed, we can derive various applications of the *Legion* structure, which include location tracking, information dissemination and mutual exclusion, etc.

In addition, we have presented a simple, new quorum-based mobile location tracking scheme called *LegRing* that was developed based on the *Legion* structure. As we have shown in the dissertation, our *LegRing* scheme has a small quorum size, which can reduce the message cost of communication. The other advantages of our scheme are: (1) It is applicable to distributed mobile platforms with any arbitrary numbers of nodes. (2) The quorum sets of a *LegRing* system satisfy the properties of symmetry. Therefore, every node in this system is included in the same number of quorums and bears the same responsibility if the quorums are selected evenly. (3) By using the method of random selection of quorums with our scheme, the algorithms can achieve fully distributed and fault tolerant location management.

When implemented in the fully distributed location tracking system, our scheme can tolerate the failures of the location servers (LSs) and can not be a single point of

failure/attack. With the small quorum size and symmetric property, our scheme can reduce the loads on each server and balance the loads among location servers. Meanwhile, limiting the update and directing the query, our scheme stores the MH location information in the local location servers of quorum set as much as possible to avoid long delay caused by the possible long-distance of VLR and HLR of the centralized scheme. Thus, it yields better connection establishment delay and, under certain conditions, is cost effective compared to the two-tier centralized scheme.

When implemented in the centralized system, our scheme can tolerate the failures of the VLRs and HLR in two-tier networks at the same time, without adding or changing the hardware of the systems. Instead of raising the cost for the fault-tolerant mechanism, our scheme can improve the performance of updates and queries in comparison with the traditional two-tier scheme. Based on the location property of the user, the procedures of intra-SR update and query are fast and more effective. Hence, our scheme is not only fault-tolerant but also cost effective.

We also proposed a new scheme with cellular quorum construction to tolerate the failures of the HLR and VLRs in two-tier networks. Based on the intersectional property of the *U*-quorum and *Q*-quorum, the location information is disseminated to VLRs of the *U*-quorum's set and can be extracted from one of them by using the *Q*-quorum even though one or more location servers fail. Thus, without adding or changing the hardware of the systems in the two-tier networks, our scheme provides fault tolerance for the system. Meanwhile, with region-based approach, our scheme stores/retrieves the MH location information in the location servers of a quorum set of the local region as much as possible to avoid long delays caused by the possible

long-distance of VLR and HLR. Hence, our scheme is not only fault-tolerant but also connection establishment effective.

We have kept studying the new quorum-based schemes on some issues, for example, data replication, group mutual exclusion, distributed checkpoint recovery, and mobile sensor networks, etc. Finally, based on the *Legion* structure, we will continue to develop new distributed application schemes.