CHAPTER 7

CONCLUSION AND FUTURE WORK

7.1 SUMMARY OF CONTRIBUTIONS

This thesis proposes the design of an efficient and resilient content distribution which involves the construction of semantic overlay network of surrogate servers based on dominating set and its variants and design of an efficient and resilient replication algorithm to disseminate the content among the surrogate servers.

This thesis presents an efficient and fault resilient replication algorithm (EFRRA), which can be used to replicate the content among the surrogate servers in a faster manner. This algorithm is useful in maintaining the fault resiliency during surrogate server failure.

The performance of EFRRA content replication algorithm is analyzed and its performance is compared with the performance of different content replication algorithms such as Sequential Unicast, Multiple Unicast, Fast Replica, Resilient Fast Replica, Optimal Fast Replica, Optimal Fast Replica and Tornado Codes algorithms on the basis of Average Replication Time and Maximum Replication Time. Performance of EFRRA algorithm during surrogate server failure is also analyzed and found that EFRRA is resilient to server failure and maintain better Delivery ratio compared to other traditional content replication algorithms.
This thesis also presents the design of the Dominating set based Semantic Overlay Network (DSON) for content distribution. The performance of different content distribution algorithms in dominating set based SON is analyzed. The performance of DSON based CDN construction is analyzed and how it would be useful in reducing the amount of replication by optimizing the number of surrogate servers for replication is also analyzed.

This thesis also investigates the design of equitable dominating set based semantic overlay network (EDSON) for content distribution. The performance of EFRRA in SON, DSON and EDSON is also analyzed. This thesis, also investigates the effect of equitable dominating set in maintaining uniform mean CDN utility and fault resiliency during surrogate server failure. This thesis presents the comparative study among different CDN construction methodologies such as SON, DSON and EDSON based CDN in terms of Mean Response Time, Latency, Hit Ratio Percentage, and Mean CDN Utility.

This thesis also investigates the requirements for Quality of Service (QoS) in content delivery and implements the QoS aware dominating set based Semantic Overly Network (QADSON) for content distribution with three specified QoS constraints such as exact-1 domination, controlled redundancy and fault tolerant. The performance of EFRRA in SON, DSON, EDSON, and QADSON based CDN is analyzed based on delivery ratio and Average Replication Time. The performance of QDSON based CDN is analyzed and compared with that of the performance of SON, DSON and EDSON based CDN in terms of user perceived Quality of Service parameters such as Mean Response Time, Mean CDN Utility, hit ratio percentages, Maximum size of CDN, Latency, Number of Completed Requests, Rejection rate and Mean CDN Load.
7.2 CONCLUSION

Design of an efficient and resilient content distribution network becomes more important for disseminating popular content to the end users in a reliable and timely manner. Fault resilient content distribution is required in many real time multimedia applications with acceptable Quality of Service (QoS) requirements. Many content distribution approaches are available to distribute the content, but these approaches are found to be lacking in fault resiliency during surrogate server failure.

This thesis proposes an Efficient and Fault Resilient Replication Algorithm to distribute the content to surrogate servers. Simulation experimental results shows that EFRRA significantly reduces file replication time compared to traditional content replication algorithms such as Sequential Unicast, Multiple Unicast, Fast Replica, Resilient Fast Replica, Optimal Fast Replica, and Tornado Codes. Performance analysis is carried out to evaluate the efficiency of Sequential Unicast, Multiple Unicast, Fast Replica, Resilient Fast Replica, Tornado Codes, and EFRRA algorithms in terms of Average Replication Time, Maximum Replication Time. This thesis also analyzed the performance of EFRRRA and compared its performance with Sequential Unicast, Multiple Unicast, Fast Replica, Resilient Fast Replica and Tornado Codes in terms Delivery ratio during surrogate server failure.

In this thesis, dominating set and its variants such as equitable dominating set and QoS Aware Dominating Set are used to cluster or group the surrogate servers and form the semantic overlay network. This semantic overlay network provides logical infrastructure of the CDN.

Dominating set is applied to logically group the surrogate servers to form the semantic overlay network in which Sequential Unicast, Multiple Unicast, Fast Replica, Resilient Fast Replica, Tornado codes and EFRRA are
applied to distribute the content among the surrogate servers. The effect of Dominating set in SON formation is analyzed and observed that full replication can be carried out in 75% of surrogate servers instead of all the servers. It is inferred that dominating set based SON is useful in reducing the amount of replication by optimizing the number of surrogate servers for replication. The performances of Sequential Unicast, Multiple Unicast, Fast Replica, Resilient Fast Replica, Optimal Fast Replica, Tornado Codes and EFRRA algorithms in DSON are analyzed in terms of Average Replication Time, Maximum Replication Time and Delivery ratio. It is observed that EFRRA achieves competent delivery ratio of above 0.94 always even though the Surrogate Server Failure Fraction is 0.5.

This thesis also presents the Equitable Dominating set based Semantic Overlay Network (EDSON) to construct the logical infrastructure of the content distribution network in which EFRRA is applied to disseminate the content among the surrogate servers. The effect of equitable dominating set is analyzed and observed that full replication can be carried out in 60 percentages of surrogate servers instead of all the surrogate servers. Performance analysis is carried out to examine the performance of EFRRA in equitable dominating set based semantic overlay network in terms of Average Replication Time, Delivery ratio, Reception efficiency and Encoding and Decoding time. This thesis investigates the performance of EDSON based CDN and compared its performance with SON based CDN and DSON based CDN in terms of Mean CDN Utility, Mean Response Time, Hit Ratio Percentage and Latency.

This thesis proposes the Quality of Service (QoS) Aware Dominating set based Semantic Overlay Network (QADSON) to construct the logical infrastructure of the content distribution network in which EFRRA replication algorithm is applied to disseminate the content among the
surrogate servers. The effect of QoS aware dominating set is analyzed and observed that full replication can be carried out in 55 percentages of surrogate servers instead of all the surrogate servers. Performance analysis is carried out to examine the performance of EFRRA in terms of Average Replication Time, Delivery ratio in SON, DSON, EDSON and QADSON based CDN. It is observed that QADSON based CDN is very useful in maintaining uniform Mean CDN Utility ($U_{\text{Mean}}$) of 0.95. Performance evaluation is carried out to quantify the performance of QADSON based CDN in terms of Size of CDN, Latency, Hit Ratio Percentage, Number of Completed Requests, Rejection rate and CDN Load.

The performances of all the proposed algorithms are analyzed and results produced by them are found to be better than those of the existing algorithms reported in the literature. Efficient and fault resilient strategies are incorporated in to the proposed algorithms for handling failure situations.

7.3 SCOPE FOR FUTURE WORK

The first extension of this thesis work is to upgrade the traditional CDN model to provide the cloud based architecture for content delivery with well defined Service Level Agreements (SLAs). This data cloud architecture will be designed to provide the required features for high performance content via on-demand cloud service, eliminating costly capital expenditures or infrastructure upgrades.

The second extension of this work could be the design of QoS Aware Dominating set based data cloud architecture which would be deployed as a fully outsourced, end-to-end services platform or as a complement to a CDN provider’s existing infrastructure. Thus, it would provide flexibility to CDN providers and their customers (content providers) to tailor a solution to meet their unique needs.