ITR-IDM: Peer-to-Peer Data Distribution

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Project Summary

Peer-to-Peer (P2P) research has the potential for integrating results in distributed database systems and networking. This research will contribute towards a scientific study of searching, dispersion, security, economic model for P2P data distribution. In cooperation with researchers in Economics at North Western University, we plan to develop an incentive and revenue model that allows cooperation and profit maximization. This research will result in following intellectual contributions:

- A P2P media streaming model that is cost-effective, does not require powerful servers or caches, considers peers heterogeneity, handles suddenly increased client arrival rates (i.e., flash crowd). This research will increase the capacity of the system and support a large number of peers who can cooperate in downloading as well as contributing data.
- A new cluster-based *dispersion* and *searching* algorithm. First, the client clustering will be done using Border Gateway Protocol (BGP) routing tables to determine peers in close proximity. Next, we propose to use the criterion of trust, reliability, security, and history profile as a metric to select peers.
- Demonstrate the potential of the P2P model as an infrastructure for a large-scale on-demand media streaming service through simulation study on large systems. Conduct experiments and develop guidelines for high performance under different request arrival patterns such as constant rate arrivals, flash crowd arrivals, and Poisson arrivals.
- Conduct a cost-profit economic analysis to provide guidelines to identify architectures, algorithms, and protocols that are viable for large scale, dynamic configuration, and adaptation to system resources. We propose to develop an economic model in which peers share some of their resources with other peers. In return, they get incentives or rewards. As peers contribute resources to the system, the amplification of overall system capacity to serve more clients will be evaluated.
- Develop an algorithm to verify the integrity of data received during P2P data streaming, considering the timing constraints of verification and the uncertainty of trust among peers. We will evaluate the computation and communication overhead of the proposed protocol that utilizes message digest and probabilistic verification.

The scientific and experimental studies will contribute towards developing fundamental ideas to distribute data in a variety of distributed environments. The research can be applied to collaboration among the twenty two peer agencies in home land security department. We will apply the result of this research to distribute in a secure manner and create a multi-hospital database sharing of medical records for research at Indiana University Medical School. This work will have impact on the media industries for viable. multimedia distribution and video on demand. Graduate students will investigate P2P issues and learn to evaluate them through experimental studies. Undergraduates will work in a laboratory environment, build P2P systems, and investigate empirical scenarios. They will help in developing benchmarks and identifying parameters for experiments by consulting with various vendors. We will contribute to the outreach program of Center for Education and Research in Information Assurance and Security (CERIAS) at Purdue through preparation of education material and organizing workshops. Two women minority graduate students will participate in this research effort and will be encouraged to publish papers and attend conferences. Undergraduate minority students are working in our laboratory and will interact with graduate students.