The Center for Advanced Network Studies (CANs)

Initial Projects to be brought into the Center

Initially, the CANS Center houses the following active research projects, with more to follow in the future.

1. Wireless Security

The growing popularity of Wireless Local Area Networks (WLAN) raises many issues of security attacks against WLANs. Our research on WLAN security started in 2004, and the WLAN security lab environment is well established to conduct various security experiments. The current and previous research of WLAN security at Center of Network Studies (CNS) covers the following

1. Empirical studies of performance overhead of various security approaches, such as Virtual Private Network (VPN), Wired Equivalent Privacy (WEP), Temporal Key Integrity Protocol (TKIP), and Advanced Encryption Standard (AES).
2. Empirical studies of performance impact of various Denial of Service (DoS) Attacks, such as authentication/association flooding attacks, deauthentication attacks, and disassociation attacks.
3. Implementation and performance study of the new 802.11w draft which is to protect 802.11 management frames.
4. Simulation models of security protections.
5. Detection of Rogue AP and evaluation of effectiveness of various detection techniques.

Publications:


2. Network Management

The continual growth of telecommunications and data networks in terms of size and service functions result in increased complexity of the network management process. The legacy approaches of Command-Line Interface (CLI) and Simple Network Management Protocol (SNMP) are limited in supporting today’s complex network environment. Our research explores the newly approved IETF protocol, Network Configuration Protocol (NETCONF) along with its accompany data model, YANG (still an IEEE draft standard. The research of Netconf at the CNS is supported by a leading product vendor Tail-f which provides us their flagship product, ConfD. The research on network management started in 2008, and the current research includes the following:

1. A framework for formal specification of network configuration and automation of validation – currently, we are able to demonstrate this function of RIP configuration, and we plan to expand its functions to include OSPF, VPN, STP, Firewall, and NAT.
2. Integration of Netconf and Yang for configuration management.
3. A framework for automation of static network configuration management – a static configuration is specified by the formal language from Task-I.
4. A framework for automation of dynamic network configuration management – a central network management system is deployed to monitor the key network performance metrics. When the network topology or traffic pattern are changed, alarms will be triggered and a new configuration will be generated and provisioned to the network devices.

Publications:

2. James Yu and Imad Al Ajarmeh, "An Empirical Study of the NETCONF Protocol", The Sixth International Conference on Networking and Services (ICNS 2010), Cancun, Mexico, March 2010

3. VoIP Traffic Engineering

The wide deployment of broadband, reliable, and cost-efficient IP networks is leading a major paradigm shift in the telecommunication world. The trend to an all-IP networks is affecting the traditional approach to traffic engineering which is to balance the trade-off between provisioning of network resource and service quality. Our research on VoIP traffic engineering started in 2007, and we are currently in cooperation with a service provider, Neutral Tandem, which provides us the real traffic data on their tandem networks. The current research includes the following:

1. Empirical study of the Erlang model and its applicability to VoIP Call Admission Control (CAC).
2. Collection of real-time voice tandem traffic and the development of a Non-homogeneous Poisson Process (NHPP) model for traffic intensity.
3. Development of a stochastic traffic model for call holding time.
4. From traffic intensity and call holding time, we will develop a new traffic engineering model for VoIP services.
5. We plan to apply the new traffic engineering model to develop a dynamic bandwidth allocation algorithm. This new approach is expected to significantly improve the network utilization and call capacity without capital investment on more bandwidth.

Publications


4. Operating System Enhancements for Network Performance

There are a variety of means by which current operating systems can be enhanced to support specific customized network applications more efficiently. In addition to focusing performance tuning on networking code, these systems can also be designed to provide additional information for use by application programs. The current research includes:
1. Modifications to the Linux operating system to provide enhanced “look-ahead” notification of financial system messages being processed in input queues. This gives financial system engine applications more information to be used in deciding whether sufficient information has been gathered to make trading decision or whether more is needed.

Publications