

Security Issues in Mobile Networks with Movable Base Stations

Report of CERIAS funded project, 2000

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Goal:

Modern mobile networks are highly dynamic and we study the environment where everything is moving, including the base stations. The availability of services provided by a single base station cannot be guaranteed due to the movement or failure or attack on the base station. This leads to serious consequences. Mobile hosts get disconnected from the rest of the network. The goal of this research is to make communications secure and provide for the survivability by avoiding the single point of failure. We developed solutions to fault-tolerant authentication and key management issues in group communications and assess their impact on various mobile environments by conducting scientific experiments. Our research contributes towards:

- The development of new authentication algorithms that make mobile networks survivable to hostile attacks and adaptable to dynamic movements.
- The development of new key management schemes that support confidential and integrated group communications.

Accomplishments:

We proposed and evaluated two architectures for achieving fault-tolerant authentication. We developed efficient algorithms for key management operations and studied the impact of key parameters on the performance of these algorithms. We proposed new wireless network architecture to achieve flexibility and scalability, and to integrate the fault-tolerant authentication schemes. We have developed modules in **ns2** (network simulator) to support the new architecture and experimental studies. For more details we refer to the following papers and technical reports.

We have been successful in making advances in this research and have obtained external funding from NSF and Darpa. We have collaborated with TRW and developed several proposals for future activities with Mr Dave Capka and Frank Beltz. We have written a proposal for Collaborative Technology Alliance for Army Research Lab with Northrup Grumman and writing a proposal to NIST with General Electric. Our work was included in the successful proposal by Purdue to Indiana 21st Century program for e-commerce work.

1. Experiments:

- **Study of Virtual Home Agent Authentication Scheme** (research paper b)
- **Study of Key Priorities in Hierarchical Authentication Scheme** (research paper h)
- **Study of Hierarchical Hybrid Network** (research paper g)

2. Research Papers:

- (a) **Adaptability and Security in Multimedia Systems**, B. Bhargava, in *Proc. of the IEEE Intl. Conference on Database Expert Systems (DEXA-99)*, Florence, 1999, pp. 1-5
 - (b) **Fault-tolerant Authentication in Mobile Computing**, B. Bhargava, S. Kamisetty and S. Madria, in *Intl. Conference on Internet Computing (IC 2000)*, Las Vegas, Jun. 2000
 - (c) **Experimental Evaluation of Design Tradeoff in Specialized Virtual Machine for Multimedia Traffic in Active Networks**, S. Wang and B. Bhargava, in *Proc. of the IEEE Intl. Conference on Multimedia System*, New York, Aug. 2000, pp 412-418
 - (d) **An Adaptable Network Architecture for Multi-media Traffic Management and Control**, S. Wang and B. Bhargava, in *Proc. of the IEEE Intl. Conference on Multimedia System*, New York, Aug. 2000, pp 670-675
 - (e) **Secure Mobile Systems**, B. Bhargava, in *Intl. Conference on Mobility in Databases and Distributed Systems*, London, Sep. 2000, pp 1-7
 - (f) **Secure Mobile Networks**, B. Bhargava, in *Proc. of Conference on Dependable Computing*, Los Angeles, Dec. 2000
 - (g) **Achieving Flexibility and Scalability: A New Architecture for Wireless Networks**, Y. Lu and B. Bhargava, to appear in *Intl. Conference on Internet Computing (IC 2001)*, Las Vegas, Jun. 2001
 - (h) **On Assigning Priorities of Keying Parameters in a Secure Mobile Network**, D. McClure and B. Bhargava (submitted for publication)
3. **Talks:** Cambridge University (Sep. 2000), CERIAS Seminar (Oct. 2000), University of Cincinnati (Nov. 2000), University of Kentucky (Nov. 2000), 2nd CERIAS Symposium (Apr.2001)
 4. **Chairman** of IEEE Workshop on “Reliable and Secure Application in Mobile Environment” (www.umr.edu/~madrias/srdsw.html), New Orleans, Oct. 2001, Co-sponsored by CERIAS
 5. **Represented** CERIAS in “Telecommunications & Information Security” workshop in Tulsa, Sep. 2000