

## **Dynamic Ad-Hoc Network Simulator Using Bloom Filters**

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A Wireless Ad hoc network is a decentralized type of wireless network that does not rely on a pre-existing infrastructure, instead, each node participates in routing by forwarding data to other nodes. The determination of which nodes forward data is made dynamically based on network connectivity and the routing algorithm in use. In the case of the simulator developed by Dozier, Salamatian, and Rubenstein, a two-phase Bloom filter data structure is used where each node has two bloom filters. The nodes can switch between filters, store information, and verify whether a message has been added to the filter during and after the storing process.

The simulator was first written in Python. Olivera used C++ data structures to translate the simulator to C++. Classes with public variables and functions, inheritance, vector arrays, and separate functions were implemented during the translation of the program. Vector arrays were the best fit for the development of filters and node structures since they presented a faster access time to information than a list array.

During the translation of the simulator, Dozier and Olivera found a different approach for utilizing the two-phase bloom filter. They used a copy of each filter to secure real-time data. The main result of this project was to improve the program structure and its complexity time during situations where a large amount of data is broadcast in a network. This means that, instead of running for days, it could take just hours to communicate with all the nodes.

### **References:**

- [1] Bloom, Howard. "Space/time trade-offs in hash coding with allowable errors." July 1970.  
<https://dl.acm.org/doi/10.1145/362686.362692>
- [2] Partow, Arash. "General Purpose Hash Function Algorithms." Partnow.net.  
<http://www.partow.net/programming/hashfunctions/index.html>
- [3] Pham, Francesco. "graph.cpp." Repository Github under "frankplus." July 17, 2016.  
<https://github.com/frankplus/frank/blob/master/graph.cpp>