**IMPLEMENTATION**

**MODULES:**

* Test Packet Generation
* Generate All-Pairs Reachability Table
* ATPG Tool
* Fault Localization

**MODULES DESCRIPTION:**

**Test Packet Generation:**

We assume a set of test terminals in the network can send and receive test packets. Our goal is to generate a set of test packets to exercise every rule in every switch function, so that any fault will be observed by at least one test packet. This is analogous to software test suites that try to test every possible branch in a program. The broader goal can be limited to testing every link or every queue. When generating test packets, ATPG must respect two key constraints First Port (ATPG must only use test terminals that are available) and Header (ATPG must only use headers that each test terminal is permitted to send).

**Generate All-Pairs Reachability Table:**

ATPG starts by computing the complete set of packet headers that can be sent from each test terminal to every other test terminal. For each such header, ATPG finds the complete set of rules it exercises along the path. To do so, ATPG applies the all-pairs reachability algorithm described. On every terminal port, an all- header (a header that has all wild carded bits) is applied to the transfer function of the first switch connected to each test terminal. Header constraints are applied here.

**ATPG Tool:**

ATPG generates the minimal number of test packets so that every forwarding rule in the network is exercised and covered by at least one test packet. When an error is detected, ATPG uses a fault localization algorithm to determine the failing rules or links.

**Fault Localization:**

ATPG periodically sends a set of test packets. If test packets fail, ATPG pinpoints the fault(s) that caused the problem. A rule fails if its observed behavior differs from its expected behavior. ATPG keeps track of where rules fail using a result function “Success” and “failure” depend on the nature of the rule: A forwarding rule fails if a test packet is not delivered to the intended output port, whereas a drop rule behaves correctly when packets are dropped. Similarly, a link failure is a failure of a forwarding rule in the topology function. On the other hand, if an output link is congested, failure is captured by the latency of a test packet going above a threshold.