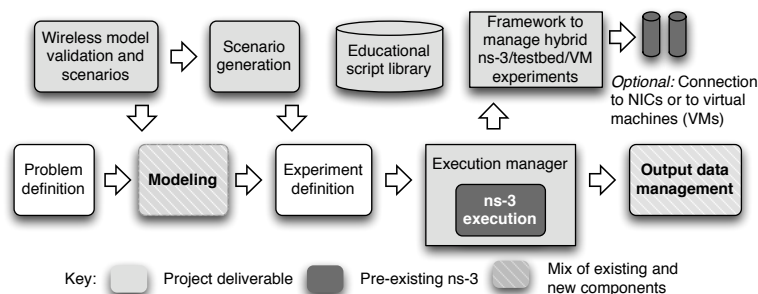


Project Summary: CI-ADDO-EN: Frameworks for ns-3

The University of Washington, Georgia Institute of Technology, and Bucknell University propose to extend the ns-3 discrete event network simulator (a free, open-source software project founded by an NSF CRI grant) with a four-year program that will deliver software frameworks to automate the experimental process, generate scenarios, perform validation of simulation models, increase usability for hybrid virtualized/simulation experiments, and make the tool more suitable for educational use.

The ns-3 simulator has been in development since 2006 and claims a steadily growing, large user base, with over 4000 downloads per month of its released software. In order to realize the full potential of the tool and meet the technical demands, the project needs to be expanded and carefully maintained.

Currently, users build ns-3 simulation models by selecting pieces from a library of components. The absence of guidance in building scenarios and in designing experiments leaves users with ample room for poor choices. Experiments involving the manipulation of many parameter settings and demanding a large number of runs require users to create ad hoc solutions for controlling simulation and dealing with output data. It is easy to create an error prone workflow that can compromise the credibility of a simulation study. We propose to create new frameworks that will work cooperatively to address these issues by using automation to streamline the staging and the control of experiments and by providing guidance in the construction of valid and realistic scenarios. We also propose to advance the state-of-the-art and recommend some basic practices in validation techniques for wireless models. Finally, our proposal includes improving the ease-of-use of hybrid virtualized/simulation experiments, and generating a collection of documents and scripts that will show how ns-3 can be used in education related to computer networking. The proposed work integrates together as shown below.



A large-scale collaborative development project such as ns-3 requires continued maintenance. From its inception, ns-3 has counted on the support of professional software developers whose full-time jobs are to interact with users, develop tutorials and documentation, review and merge code contributions from many contributors, debug and test the software, and make software releases. Our proposal seeks funding to continue to support this essential activity.

Intellectual merit of the proposed activity. Progress in data networking is heavily reliant on simulations, which we are now integrating with components of future testbeds being developed as part of GENI/NetSE. The literature demonstrates that the research community favors a flexible, scalable, open-source simulator. Based on their collective experience in developing and using network simulators, the PIs believe that the needs identified in the above figure are not yet being met by ns-3 or other network simulators. The proposed frameworks will raise the level of abstraction in user interactions with ns-3 making it easier to use and more likely to produce trustworthy results. This project will advance the state-of-the-art in simulator design of the identified areas, along with supporting the generation of scripts for educational use and the less glamorous yet critical activities of code maintenance, documentation, and validation.

Broader impacts of the proposed research activity. The broader impacts of this work will be extensive. Since the resulting frameworks will be freely available, they will be useful for simulation-oriented research as well as for classroom use. The project will emphasize a software development model that encourages and incorporates contributions from the user community. The large user and developer base of ns-3, and their willingness to contribute code to the simulator, will extend its capabilities substantially, beyond those available in popular commercial tools in many respects. With the continued activities proposed here, we are certain that ns-3 will establish itself as the preferred choice for research and education in networking.