

TIED – Trial Integration Environment Based on Deter

QPR December 31, 2008

Major accomplishments

Milestones achieved and Deliverables made

First public release of fedd, an implementation of the DETER Federation Architecture (DFA).

As described below, the DFA is our architecture for creating federated experiments that span multiple facilities, and for incorporating multiple facilities into a large-scale testbed environment. In addition to the source code for **fedd**, the release includes an extensive website that provides the following information:

- Overview of the DETER Federation system and **fedd**.
- Download and installation instructions.
- Configuration and operation instructions.
- Detailed developer information: Interface information, Data types, Data Bindings, Internal interfaces, Messages, etc.
- Roadmap to upcoming features.

This software release is available at <http://fedd.isi.deterlab.net/trac>

Using this release and documentation, fedd has been installed by staff at Utah's Emulab and at the University of Wisconsin's WAIL on their respective facilities.

A three-federant experiment incorporating Utah's Emulab and the USC/ISI and UCB portions of DETER, each acting as a separate federant, was demonstrated publicly at the DETER semiannual review Dec 18, 2008. The experiment was set up and controlled through a single instance of the SEER experiment control GUI running at ISI. A key point made in this demo is that the experiment appeared to the observers *exactly* as if it had been running on a single testbed.

Note that this software constitutes a first released version of "clearinghouse and component manager software" as interpreted by the TIED architecture. We anticipate a second release of this software, with additional capabilities, at approximately the end of the next quarter.

Description of work performed during last quarter

Activities and findings

1) Ongoing development of the DETER Federation Architecture (DFA) system that underlies the TIED proposal.

A brief description of the DETER Federation Architecture is given here:

The DFA architecture and implementation allows a researcher to construct experiments that span multiple testbeds, networks, and other system elements by dynamically acquiring resources from remote elements and configuring them into a single experiment. As closely as possible that experiment will mimic a single DETER/Emulab experiment.

Though the experiment appears to be a cohesive whole, the facilities that loan the resources retain control of those resources. Because facilities retain this control, each facility may issue credential necessary for manipulating the federated resources. For example, a testbed that has loaned nodes to an experiment may require the experimenter to present a credential issued by that testbed (e.g., an SSH key or SSL certificate) to reboot those nodes. The system acquires those credentials on behalf of experimenters and distributes them on behalf of facilities.

Facility administrators may use the system to establish regular policies between facilities to share resources across many users of a facility. Similarly, a single user with access to multiple facilities can use the same interfaces to coordinate experiments that share his available resources, assuming sharing those resources does not violate the policy of any of the constituent facilities. A diagram of the DFA is shown below.

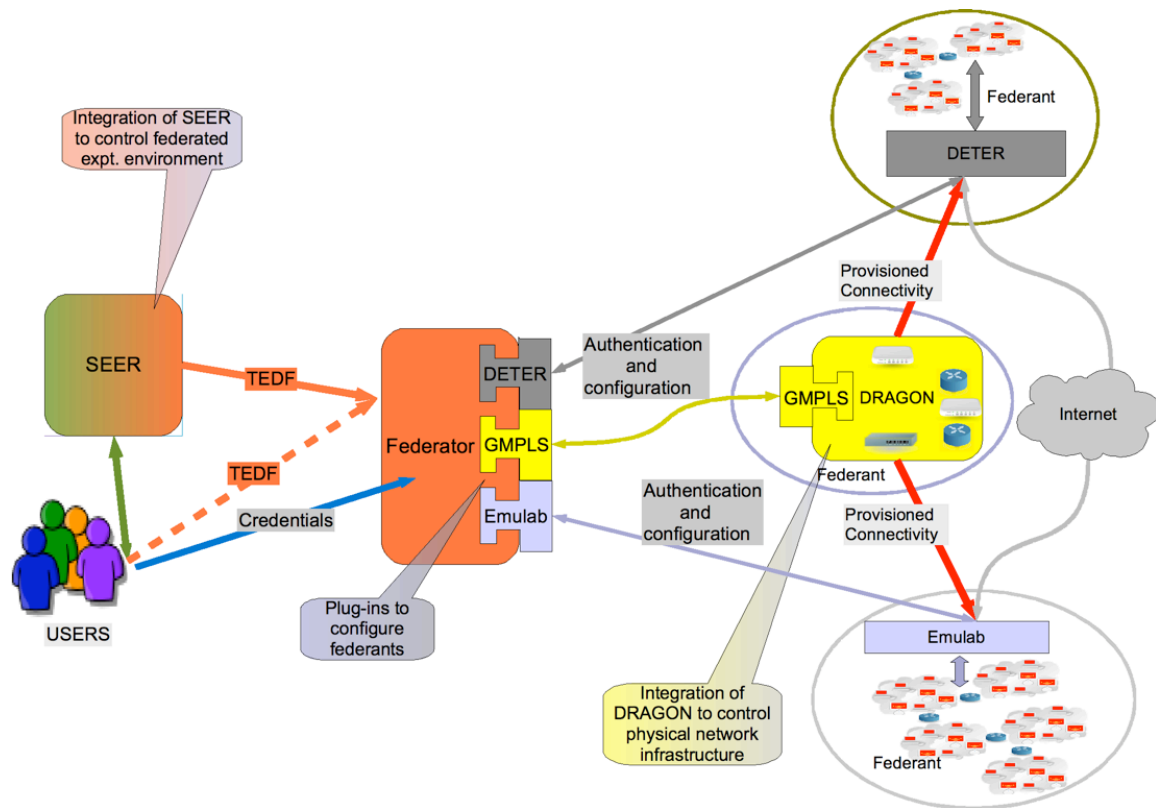


Figure 1: DETER Federation Architecture

2) Initial study of interfaces and mechanisms required to incorporate DRAGON network control into the DFA.

Our proposal discusses generalization of the DETER Federation Architecture to control a variety of network types and other facilities, with particular focus on federation with networks controlled by DRAGON path allocation software. Working with the DRAGON project leader at ISI East, we have completed an initial requirements and design study for this integration. We expect to carry out a detailed design exercise and begin implementation of this capability in the next calendar quarter.

A finding beyond the basic feasibility of the approach is recognition on the part of the DRAGON developers that the approach we take within the DFA for federated authorization and access control would be useful to DRAGON itself. DRAGON implements network control across multiple, federated network systems, but today implements only a simple chained access model. We intend to explore incorporation of our access control model within the DRAGON software as a parallel project to our TIED development.

3) Initial study of DETER interconnection with regional and national networks using TIED's federation and control architectures.

We have completed an initial study of connection paths available to interconnect DETER facilities at USC/ISI and UC Berkeley regional and national networks, and thereby to other testbeds and eventually to a new DETER facility planned for ISI East. A cartoon map showing some feasible paths to sites of interest is shown below. A finding resulting from this study is that the most difficult to complete from an engineering perspective are those in

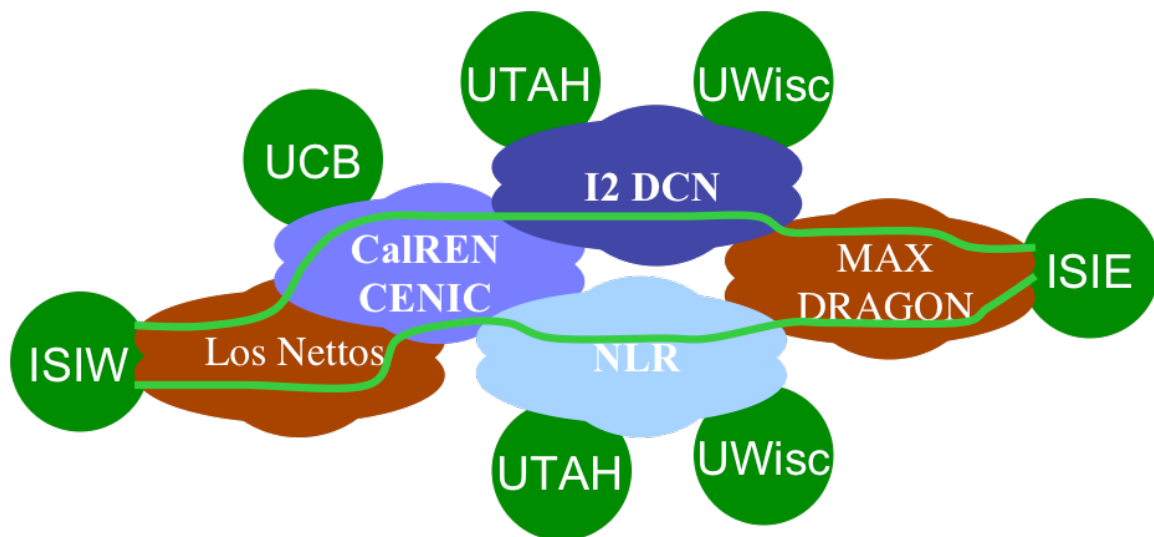


Figure 2: Cartoon Map of Possible Initial Connects for DETER/TIED

the Los Angeles area. Connections in Northern California, Arlington, VA, and to other testbed facilities appear to be more straightforward.

Project participants

- 1) Individuals directly supported by TIED award:
John Wroclawski, PI
Ted Faber, Research Computer Scientist
- 2) Individuals contributing to the project with outside support:
Kevin Lahey, Systems Programmer
Tom Lehman, Research Computer Scientist

Publications

- 1) **A Federated Experiment Environment for Emulab-based Testbeds.** T. Faber and J. Wroclawski. 5th International Conference on Testbeds and Research Infrastructures for the Development of Networks & Communities (TRIDENTCOM 2009) (to appear). April

6-8, 2009, Washington D.C., USA.

This paper presents an overall description of the DETER Federation Architecture that underpins our work on TIED; outlines key elements of the architecture including resource allocation, authorization and access control, and experiment control environment, and presents a brief description of the development prototype.

- 2) **Current Developments in DETER Cybersecurity Testbed Technology.** T. Benzel, R. Braden, T. Faber, J. Mirkovic, S. Schwab, K. Sollins, and J. Wroclawski. Cybersecurity Applications and Technologies Conference for Homeland Security (CATCH 2009) (to appear). March 3-4, 2009, Washington, DC., USA.

This paper presents rationale and initial design for three key areas of current technical work on DETER: Federation, Risky Experiment Management, and Experiment Health Management. Although the paper describes work outside of the TIED award per se, we list it here because it discusses several technologies related to TIED and because it captures work of significant value to GENI but funded by another agency of the US Government.

Outreach activities

Nothing particular to report.

Collaborations

- 1) Utah Emulab group (Rob Ricci and staff) – development and testing of the DETER Federation Architecture software.
- 2) WAIL (Paul Barford and staff) – development and testing of the DETER Federation Architecture software.
- 3) SPARTA (Steve Schwab) – Development of attribute based security models for federation (to be implemented in the DETER Federation Architecture code base)
- 4) SPARTA (Steve Schwab, Brett Wilson) – Development of support for federated experiments within the SEER Experiment Control Environment.
- 5) DRAGON project at ISI-East. See discussion under Activities and Findings, above.

Other Contributions

Nothing particular to report.