SIMULBED AYAME Associate Team

Report for 2013

Web site: `http://planete.inria.fr/Simulbed/`

1 Summary of work done in 2013

Our work on the Simulbed experimentation platform focused on two main directions: Direct Code Execution (DCE) framework and Network Experiment Programming Interface (NEPI).

1.1 Direct Code Execution (DCE)

We released version 1.1 of DCE on September 1st, 2013. Several new features have been added. First, *Aspect-based tracing*, which allows us to use tracing facility in DCE when simulating unmodified code. This feature is important for debugging and protocol analysis purposes as it enables to investigate which function is called or how many messages of a particular protocol are exchanged for example. We introduced a development suite for network protocol design that includes code coverage measurement using the gcov tool, memory analysis under distributed protocol operation with valgrind, and distributed code debug with gdb. In addition to the above new features supported, we wrote a public web page for DCE (see URL `http://www.nsnam.org/overview/projects/direct-code-execution/`) along with manuals (see URL `http://www.nsnam.org/docs/dce/manual/html/index.html`), and proposed a stable software release cycle so that users can choose to use either the stable DCE version or the latest experimental version. We also designed the bake building and integration tool to make easier the DCE installation procedure, see URL `http://www.nsnam.org/docs/bake/tutorial/html/index.html`.

Two papers on DCE have been accepted in 2013. The first one introduces DCE Cradle, a feature that enables to use ns-3 native applications over DCE Linux kernel stack. DCE Cradle utilizes standard Linux kernel network stacks and provides transparent socket interfaces to the ns-3 applications. This allows us to study Linux kernel protocols with various useful applications of ns-3, such as traffic generators or routing protocols. This paper presents a short overview of the DCE architecture, the cradle feature, a use case involving the DCCP protocol along with some benchmarks[2]. The second paper provides a full description of the DCE framework, and has just been accepted at the prestigious ACM CoNEXT conference [1]. It describes in detail the architecture of DCE, reports on packet processing benchmark and showcases key features of the framework with various use cases. This paper also demonstrates that DCE can be used to write *runnable papers*, i.e., papers where researchers can easily reproduce experiments shown in papers.

A tutorial on how to experiment CCN [7] using the CCNx implementation from PARC with DCE has been presented at the ICN workshop in January 2013 [4]. A demonstation on how to use DCE with different use cases has been done in the ACM MSWiM conference in Barcelona on November 4, 2013 [5].

1.2 Network Experiment Programming Interface (NEPI)

In September 2013, we released version 3.0 of NEPI, the framework that provides an experiment description language to describe experiments during the design stage, and the mechanisms to automate the deployment and control of experiments and collect results, during the execution stage. The previous version of the experiment description language lacked sufficient expensiveness to describe experimental workflows (i.e. to specify a sequence of events that need to take place during the experiment in a flexible way). Also, to support a larger set of experimentation scenarios with NEPI, we needed a more easily extensible architecture to make it easier the support of new experimentation environments and new types of resource (e.g. virtual machines, switches, tunnels, etc).

Version 3.0 of NEPI includes a re-design of its architecture to allow expressing workflows as part of the experiment description, and to enable easier extensibility of NEPI to support new experimentation environments and resources. This new architecture adds to NEPI the capability to automate execution of experiments in any SSH-enabled Linux testbed (PlanetLab included), and in OMF-based wireless testbeds. A full release of NEPI, including enhanced user documentation, a new WEB site, a wiki page and a bugzilla bug reporting page, is planned for December 2013.

Finally we have used NEPI to evaluate the performance of CCN overlays on top of the Internet. We constructed different overlay topologies on PlanetLab, in which we varied the topology configuration, the traffic patterns and different CCN parameters with the objective to find correlations between these variables and the performance obtained. A paper is in preparation and the capabilities of using NEPI to easily run CCNx experiments in realistic wired and wireless environments has been demonstrated in the CCNx workshop at PARC in September 2013 [6].

2 Next Year Program

- We plan to add the support of OpenFlow (OF) protocol in DCE. Today, a very old version of OF is supported and it is not trivial to port the latest one as the OF API has changed a lot. Using DCE will reduce the development cost to port OpenFlow and will allow to simulate with ns-3 with the latest features of OF with minimal cost.

- We plan to improve the support for simulated and emulated experimentation in NEPI, in order to express experiment workflows involving also ns-3 and NETNS components.

- We will use NEPI to conduct challenging research experiments, including evaluation of OpenFlow and ICN solutions such as NetInf on realistic environments, which will allow us to assess the usefulness and the performance of the framework.

- We plan to write missing wrapping code between ns-3 and DCE in order to be able to launch with NEPI hybrid experiments including real application codes running over ns-3 through DCE.

- We plan to disseminate our work and to increase the DCE and NEPI user community by promoting the use of these two frameworks in the classroom (e.g. Ubinet Master students) and in research institutions. Examples include how to write runanble papers, how to reproduce other researchers results using DCE and evaluate further their protocols in extended scenarios using both DCE and NEPI.

3 Meetings/Visits in 2013

The following meetings have been held in 2013.

- March 5-7, 2013: Meeting at INRIA (visit of Hajime Tazaki during the WNS-3 workshop)
- June 24-27, 2013: Meeting at INRIA (visit of Hitoshi Asaeda and Hajime Tazaki)
- October 7-9, 2013: Meeting at NICT (visit of Alina Quereilhac, Emilio Mancini and Thierry Turletti)
- November 4-6, 2013: Meeting in Barcelona (Emilio Mancini and Hajime Tazaki during the MSWiM'13 conference)

4 Budget requested for 2014

4.1 Exchanges scheduled for 2014

Exchanges scheduled from France to the partner country (researchers' name, including students, and expected duration of stays)

- Meeting at NICT in Tokyo, one week in May 2014
  Visitors: Walid Dabbous, Thierry Turletti, Alina Quereilhac, Emilio Mancini

Exchanges scheduled from the partner country to France (researchers' name, including students, and expected duration of stays

- Meeting at INRIA Sophia Antipolis, one week in February 2014
  Visitors: Hitoshi Asaeda, Hajime Tazaki
- Meeting at INRIA Sophia Antipolis, one week in October 2014
  Visitors: Hitoshi Asaeda, Yuji Sekiya, (One young researcher)

Note that the above two meetings are not in the same budget from Japanese side, because the project from Japanese side belongs to a Japanese fiscal year, starting from Apr.1 and ending at Mar.31. One is this year's budget, and the other is the next year's budget (if the Designet proposal submitted in September is accepted).

Expected expenditures for 2014

		Senior researcher	PhD student	Senior Engineer	Total
Visits from Inria to partner	Nb of persons Estimated costs	2 8K Euros	1 4K Euros	1 4K Euros	4 16K Euros
Visits from partner to Inria	Nb of persons Estimated costs	2 990,000 JPY			2 990,000 JPY
Visits from partner to Inria	Nb of persons Estimated costs	2 1,100,000 JPY	1 500,000 JPY		3 1,600,000 JPY

Budget proposal for 2014

Financial support request to INRIA	16000 Eur
Expected financial and/or material contribution from the international partner to the project Travel: 2,590,000 JPY (990,000 (Feb/2014) + 1,600,000 (Oct/2014)) Total: 2,590,000 JPY Again, above two meetings are not in the same budget from Japanese side.	2,487,000 JPY

References

[1] Hajime Tazaki, Frederic Urbani, Emilio Mancini, Mathieu Lacage, Daniel Camara, Thierry Turletti, Walid Dabbous, "Direct Code Execution: Revisiting Library OS Architecture for Reproducible Network Experiments", to appear in Proc. of ACM CoNEXT conference, Santa Barbara, CA, Dec. 9-12, 2013.

[2] Hajime Tazaki, Frederic Urbani, Thierry Turletti, "DCE Cradle: Simulate Network Protocols with Real Stacks", in Proc. of ns-3 workshop at Simutools, Cannes, March 5, 2013. [Best Award Paper]

[3] Alina Quereilhac, Priya Mahadevan, "Evaluating Costs of CCN Overlays", poster at CCNxCon workshop, Palo Alto, CA, Sep 5-6, 2013.

[4] Daniel Camara, "CCNx on ns-3", remote presentation at ICN workshop, TIP 2013, Honolulu, Jan 15, 2013.

[5] Hajime Tazaki, Emilio Mancini, Daniel Camara, Thierry Turletti, Walid Dabbous, "Direct Code Execution: Increase Simulation Realism using Unmodified Real Implementations", demo at ACM MSWiM, Barcelona, Spain, Nov. 3-8 2013.

[6] Alina Quereilhac, Julien Tribino, Thierry Turletti, Walid Dabbous, "Running Live CCNx Experiments on Wireless and Wired Testbeds with NEPI", demo at CCNxCon workshop, Palo Alto, CA, Sep 5-6, 2013.

[7] V. Jacobson, D. K. Smetters, J. D. Thornton, M. F. Plass, N. H. Briggs, R. L. Braynard, "Networking Named Content", ACM CoNEXT Conference, Rome, December, 2009.