

# The MANIAC Challenge at IETF 87

## Student competition makes network problem solving fun

By Emmanuel Baccelli, Felix Juraschek, Oliver Hahm, Thomas C. Schmidt, Heiko Will, and Matthias Wählisch

The 87th IETF meeting was populated by MANIACs—students participating in an algorithmic communication and programming contest. The MANIAC (Mobile Ad Hoc Networking Interoperability And Cooperation) Challenge is a competition to better understand cooperation and interoperability in ad hoc networks. The third edition was held 27–28 July 2013 in Berlin, Germany. It was the first time that the MANIAC Challenge was colocated with an IETF meeting, and it was a big success.

### About the MANIAC Challenge

During the MANIAC Challenge, competing teams form a wireless ad hoc network. Participants' end devices are not only connected among each other, but also simultaneously connected to an infrastructure backbone. Teams are judged based on how much of their relayed traffic reaches its destination.

---

### Five teams from North America, South America, and Europe participated in the MANIAC Challenge 2013.

---

The focus of this year's MANIAC Challenge was on developing and comparatively evaluating strategies to offload traffic usually carried by infrastructure access points (e.g., providers) via ad hoc forwarding using handhelds (e.g., customers). The incentive for customers is discounted monthly fees, the incentive for operators is decreased infrastructure costs. The idea was to demonstrate forwarding strategies that don't degrade user experience while offering significant mobile offloading on the infrastructure.

The competition had multiple rounds, each round comprised multiple games. After each round, teams could refine their strategies. Each game started with a bidding request of a randomly selected access point (AP) to deliver a data packet to another randomly selected AP. The AP indicated the maximum budget available for this data packet, a fine, and a maximum packet delivery time. Based on the lowest offer, the AP selected a tablet for forwarding. Each handheld should deliver the packet to the destination, either via the ad hoc network or the backbone based on independent bidding.

A fine must be paid in the case of unsuccessful packet delivery (e.g., packet loss or exceeding the packet delivery time).

### Basic Setup

All devices (i.e., WiFi access points and tablets) operated in ad hoc mode. Tablets ran Android, OLSR (Optimized Link State Routing), and the MANIAC framework. The MANIAC framework included an API (application programming interface), which provided function calls for bidding and auction and for sending and receiving data, as well as full network topology information through OLSR, which teams leveraged for their forwarding strategies.

Before the competition started, participants implemented a first version of their concept. Each team was free to design its own forwarding and bidding strategy, but it needed to comply with a detailed rule set. Challenge organizers monitored packets and collected statistical data to analyze the contest and identify incorrectly behaving nodes.

### Global Participation

Five teams from North America, South America, and Europe participated in the MANIAC Challenge 2013. Isaac Supeene (University of Alberta), René Steinrücken (Hamburg University of Technology), and Asanga Udugama (University of Bremen) implemented selfishness as a virtue in MANETs (Mobile Ad-hoc Networks). The mobile offloading strategy from Alan Ferrari and Dario Gallucci (University of Applied Sciences of Southern Switzerland) was based on a Bayesian

*Continued on next page*



MANIAC Challenge team member at the Freie Universität Berlin

*The MANIAC Challenge at IETF 87, continued*

network. Di Li and Asya Mitseva (RWTH Aachen) tried a no-regret learning strategy. Cristian Chilipirea, Andreea-Cristina Petre, and Ciprian Dobre (University Politehnica of Bucharest) presented a wolf-pack strategy, in which rich nodes were taxed. Gabriel B. T. Kalejaiye, Joao A. S. R. Rondina, Leonardo V. V. L. Albuquerque, Tais L. Pereira, Luiz F. O. Campos, Raphael A. S. Melo, Daniel S. Mascarenhas, Marcelo M. Carvalho (University of Brasilia) followed a path-tightness strategy by analyzing the corresponding routing graph.

---

**One goal of the MANIAC Challenge was to involve young people in IETF/IRTF activities. For most of the participants, IETF 87 was their first IETF experience. The Internet Society sponsored the students' registration fees, which enabled the teams to attend the whole week.**

---

**On-site Event**

The MANIAC Challenge continued for two days. On the first day, students met at the Freie Universität Berlin, which provided the wireless setup to perform the on-site competition. Participants tested and refined their strategies during multiple rounds. The second day took place at the IETF venue and allowed MANIAC and IETF folks to discuss practical experiences. This half-day workshop included an overview



The MANIAC Challenge 2013 participants at a briefing of competition processes and results

about the MANIAC Challenge, presentations of the different offloading concepts, and talks from Stan Ratliff about the current state in the MANET working group and Henning Rogge about Freifunk and OLSR.

One goal of the MANIAC Challenge was to involve young people in IETF/IRTF (Internet Research Task Force) activities. For most of the participants, IETF 87 was their first IETF experience. The Internet Society sponsored the students' registration fees, which enabled the teams to attend the whole week. They enjoyed open-minded exchange in the different working and research groups.

**Key Findings**

A major problem was incompatible WiFi drivers that led to incorrect behavior between end devices. In contrast to the commonly applied infrastructure setting, nodes were operated in ad hoc mode. Our experiences showed much worse performance compared to the infrastructure mode. On the networking layer, the Android port of OLSR raised some problems. Heterogeneous bidding strategies occasionally



Winners of the MANIAC Challenge 2013 Performance Award



Winners of the MANIAC Challenge 2013 Strategy Award

The winners of the MANIAC Challenge were announced during the IRTF Open Meeting on Tuesday. Two prizes have been awarded: the Performance and the Strategy Awards. The Performance Award went to the team with the maximum budget after all the rounds. The Strategy Award considered the most compelling concept.

caused negative resonance due to the convergence of different training phases.

But most important, we learned that experimenting with ad hoc networks and interesting offloading strategies can be fun!

#### And the Winners Are ...

The winners of the MANIAC Challenge were announced during the IRTF Open Meeting on Tuesday. Two prizes have been awarded: the Performance and the Strategy Awards. The Performance Award went to the team with the maximum budget after all the rounds. The Strategy Award considered the most compelling concept.

Lars Eggert presented the Performance Award to Isaac Supeene, René Steinrücken, and Asanga Udugama for a predictive-greedy strategy based on fine-grained, neighbor-node profiling.

Mat Ford presented the Strategy Award to Gabriel B. T. Kalejaiye, Joao A. S. R. Rondina, Leonardo V. V. L. Albuquerque, Tais L. Pereira, Luiz F. O. Campos, Raphael A. S. Melo, Daniel S. Mascarenhas, and Marcelo M. Carvalho for their graph-analysis strategy driving towards more cooperation and lower network resource utilization.

#### Acknowledgements

The organizers of the MANIAC Challenge thank all its sponsors, in particular IETF, IRTF, and the Internet Society, which provided the appropriate setting in which to discuss the competition's challenges and results. We thank Fabian Brandt, Lennart Dührsen, Andreas Reuter, Tim Scheuermann, and Lotte Steenbrink from Freie Universität Berlin, who implemented the MANIAC API and took care of the on-site experiments (meaning, straightened all the wireless pain).



#### Further Information

- MANIAC website, <http://2013.maniacchallenge.org>
- Code Repository, <https://github.com/maniacchallenge>

