



Barcelona, March 12th 2016

Review of PhD thesis "A new dawn of naming, addressing and routing on the Internet" by Ing. Vladimír Vesely

The work of this thesis is rooted on the assumption that flaws on the naming and addressing of the objects in the TCP/IP protocol suite are behind many of the routing scalability, mobility and multi-homing problems of the current Internet. The thesis starts by investigating the influence that naming and addressing schemes have over routing in computer networks. Summarizing the work of eminences in the field, the candidate describes the objects that a complete computer network naming and addressing scheme must name (applications, nodes, Points of Attachment), the characteristics of the names assigned to these objects as well as the bindings between them (directory, route, path).

Armed with this theory, the thesis dissertation describes a number of addressing schemes that have been proposed to mitigate the naming problems of the current Internet, including RINA, the Recursive InterNetwork Architecture, which is a proposal for completely different computer network architecture. Based on an initial comparison of the merits of the different proposals, the thesis focuses on exploring two of them: LISP (Locator-Identifier Separation Protocol) as an exponent of the evolutionary path - trying to fix the current IP-based Internet - and RINA, as an exponent of the revolutionary path - proposing to build new Internets.

Chapter 4 introduces LISP and details the candidate's main contributions to this technology, dedicated to mitigate two of the well-known LISP scalability problems: site-based synchronization and locator path liveliness. In order to evaluate its contributions, the candidate contributed to the development of an OMNeT++ LISP and VRRP simulation modules. The two techniques to mitigate the aforementioned LISP problems have been evaluated using the simulator, and results showing its merits have been published in *ICNS 2015* and *The International Journal on Advances in Intelligent Systems*.

Chapter 5 introduces RINA and explains the main contribution of the thesis to the RINA state of the art: leading the design and implementation of the first OMNeT++ simulator of RINA (published in the *OMNeT++ summit 2015*).

Finally the conclusions provide a quick analysis on why LISP is not the definitive answer to the naming problem (it fails to comply with the theory described on chapter 3), while RINA's naming and addressing schemes provides the elements described by the theory in chapter 3 in a recursive fashion.

Strong points of the thesis:

- The design and development of open source simulation software, which can be re-used by other researchers in the LISP and RINA communities. This is specially true for RINASim, which is already being heavily used by other researchers in the FP7 PRISTINE project (congestion control, routing).
- A proposal to mitigate two well-known LISP issues: map-cache synchronization and locator path liveliness.
- Contributions to verifying and improving the experimental RINA specifications via RINASim design and implementation, allowed further research on RINA (congestion control, routing).

An aspect that I would like to remark is that it would have been more comfortable for the PhD candidate to keep focused on LISP, getting more publications by doing more sophisticated experiments and refining the strategies exposed in the thesis. Instead, the candidate realized LISP didn't solve the naming problem in computer networks and found out there was another promising approach - RINA - that provided all the elements of an ideal solution. It is very challenging for a PhD candidate to start working "from scratch" in a new solution, which has very few tools available for research, has to be properly communicated to reviewers of scientific conferences when writing papers, etc. **Therefore the contribution of RINASim is of very high value to the computer networking scientific community and a key enabler of further RINA research.**

Weak points of the thesis:

- Few publications, and not in high-impact journals or top-notch conferences.
- It is not clear if this thesis is the only solution proposed in the literature to solve/mitigate the LISP map-cache synchronization and locator path liveliness problems.

Recommendations:

1. In the description of the contributions to the LISP map-cache synchronization and RLOC probing, the thesis contributions are just compared to the standard LISP. It is not clear if there are no other proposals in the literature to solve these problems or - in case there are - the candidate did not provide a comparison of his approach to these other solutions. The candidate has already provided an explanation about this fact via email, which should be included in the thesis dissertation and/or mentioned during the defense of the thesis.
2. Since designing and implementing the first simulator for a completely new computer network architecture that is still under active research (and whose core specifications are still not complete) is a research exercise by itself, it would have been nice that the dissertation explained any problems found during the design and implementation, specially if they lead to discussions that contributed in consolidating the experimental RINA specifications and the theory behind them. I think that this also would provide more material for a journal paper on RINASim. If this explanation cannot be included in the thesis dissertation, it should at least be explained during the public defense.
3. Since apparently there are no other solutions to the LISP cache synchronization

and RLOC probing problems proposed in the literature, I would encourage the candidate to write an informal RFC reporting about the thesis results in these two areas (which seems to be planned according to the “Future Work” description).

4. I think that the design and development of the first RINA simulator should provide enough material for a successful publication in an indexed journal, therefore I encourage the candidate to start the work for this submission.
5. Sometimes is hard to understand if the contributions mentioned in the thesis are just the work of the candidate or involves work of other people (and how many of them), since “we” instead of “I” is used multiple times in the text. It would be very useful for the reviewers that the candidate clarified his individual contributions during the defense of the dissertation.

These recommendations will help overcoming the weak points of the thesis and maximize the impact of the candidate's work. **However, I think that the current thesis dissertation, software and publications as actually reviewed have provided enough contributions to grant the thesis successful public defense by the candidate. Therefore I strongly recommend the thesis for public defense.**

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