GPeerReview: Enhancing Peer Review With Digitally-Signed Endorsements

Michael S. Gashler
Department of Computer Science
Brigham Young University
Provo, UT 84604
mike@axon.cs.byu.edu

We propose that cryptographic digital signatures could facilitate the gradual reformation of the scientific peer review process. Such a reformation could take place in four phases as follows:

Phase 1:

Journals give a digitally-signed endorsement to the authors of papers that they accept. Such digitally-signed endorsements would benefit both the journals and the authors. They would provide a standard mechanism for validating the acceptance of a paper. This authentication could be performed by automatic systems, without requiring a human to manually query a journal's web site. In the event that a journal ever ceased operation, the signed endorsement would remain effective.

Phase 2:

The services of publication and endorsement could be decoupled. This would also benefit both journals and authors. Instead of providing actual copies of a published work, journals could simply publish a hyperlink to the author's pre-publication copy. (Already many authors pre-publish their papers with such services as http://arXiv.org.) Thus authors could publish immediately, and seek endorsements for that publication later. In addition to allowing science to advance at a faster rate, this would be more convenient for authors. It would also allow journals to focus solely on the service of endorsement. The interests of journals would be protected because authors could not alter an already-endorsed work without invalidating the digital signature on the endorsement. Further, because journals would no longer be required to store any copyrighted material, they would be exposed to less legal responsibility.

Phase 3:

Traditional journals will not consider a work that has already been published elsewhere. If journals focus only on endorsement, and no longer act as publishers, then such exclusion would become unnecessary. Authors could seek any number of endorsements for each paper. Even papers that were published prior to the existence of this system could benefit from this process. This offers an obvious advantage in the establishment of credibility over the current system where every paper is limited to exactly one endorsement. Further, individual scientists that are well-respected in their communities could provide valuable endorsements, thus restoring the original meaning of "peer review".

Phase 4:

If every digitally-signed endorsement contained a hyperlink to the vitae of the endorser, then this peer review process would naturally form a decentralized peer-to-peer network with a structure that mirrored that of the scientific community. Graph analysis techniques could be used to identify credible endorsements and filter out those that have only circular or extraneous origins. For example, a max-flow/min-cut algorithm could be used to identify the minimum set of endorsements that would need to be hypothetically severed in order to isolate a researcher from a scientific community. This is just one of many techniques that could provide a valuable measurement of the credibility of an endorsement chain. The existence of many analysis techniques would enable organizations to evaluate credibility according to their priorities. Further, there would be no single evaluation technique that dishonest researchers could attempt to game.

In order to encourage the beginning of this reformation process, we provide free tools for digitally signing endorsements at:
http://code.google.com/p/gpeerreview.