Formal analysis of Facebook Connect Single Sign-On authentication protocol

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+ third party Web sites can access to Facebook users data outside of Facebook itself.

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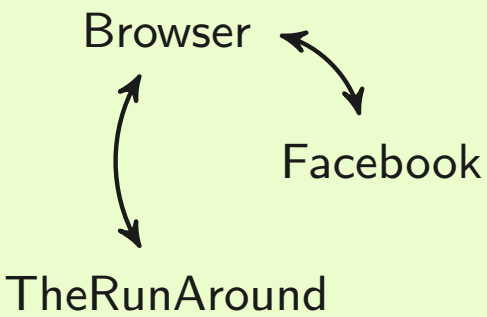

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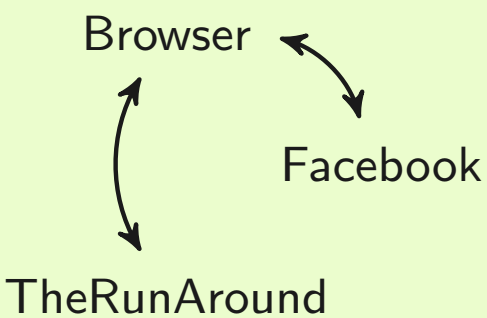

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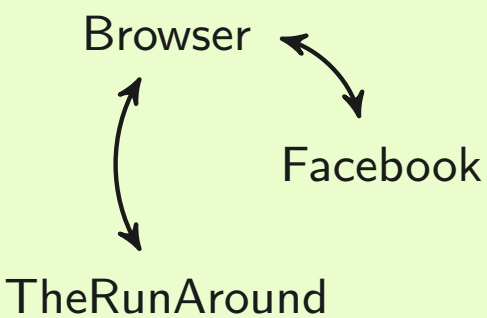

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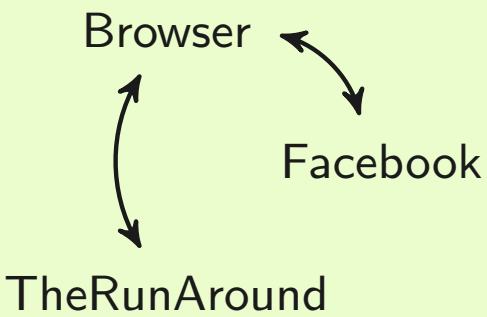

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4. we analyzed the HLPSL formalization using AVISPA.

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Weaknesses

Facebook Connect authentication protocol is subject to

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  $\Longrightarrow$ we propose an authentication of resource requests by means of a Diffie-Hellman session key.

Bibliography

A. Armando, D.A. Basin, Y. Boichut, Y. Chevalier, L. Compagna, J. Cuéllar, P.H. Drielsma, P.-C. Héam, O. Kouchnarenko, J. Mantovani, S. Mödersheim, D. von Oheimb, M. Rusinowitch, J. Santiago, M. Turuani, L. Viganò, and L. Vigneron. *The AVISPA tool for the automated validation of internet security protocols and applications*. In K. Etessami and S.K. Rajamani, editors, Proc. CAV, volume 3576 of Lecture Notes in Computer Science, pages 281-285. Springer, 2005.

A. Armando, R. Carbone, L. Compagna, J. Cuéllar, and M.L. Tobarra. *Formal analysis of SAML 2.0 web browser single sign-on: breaking the SAML-based single sign-on for Google Apps*. In V. Shmatikov, editor, Proc. FMSE, pages 1-10. 2008.

AVISPA Project. *Deliverable D6.1: List of selected problems*. Technical report, `http://avispa-project.org`, 2005.