

Технологии блокчейн в распределенных системах измерения

Рассмотрено построение распределенной системы измерений с использованием технологии блокчейн. Показана инфраструктура открытых ключей на блокчейне, приведено ее сравнение с обычными центрами авторизации. Выполнен анализ безопасности измерений.

Ключевые слова: блокчейн, децентрализация, распределенная система измерения, средство измерений, юридически значимый, законодательная метрология, безопасность измерений.

Захаров Николай Анатольевич – канд. техн. наук, доцент кафедры «Теория электрических цепей» МТУСИ, начальник отдела научно-производственного подразделения «Дозор» АО «Концерн КЭМЗ».

Список литературы

1. *F. O. Leitão, M. T. Vasconcellos, and P. C. R. Brandão.* Hardware and Software Countermeasures on High Technology Fraud at Fuel Dispensers under the Scope of Legal Metrology // IX Simposio Internacional 'Metrologia 2014', Havana, 2014, pp. 1–10.
2. *W. S. Melo Jr., A. Bessani, N. Neves, A. O. Santin, and L. F. R. C. Carmo.* Using Blockchains to Implement Distributed Measuring Systems // IEEE Transactions on Instrumentation and Measurement, vol. 68, no. 5, pp. 1503–1512, 2019.
3. *W. Melo, R. C. S. Machado, D. Peters and M. Moni.* PublicKey Infrastructure for Smart Meters using Blockchains // 2020 IEEE International Workshop on Metrology for Industry 4.0 & IoT, Roma, Italy, 2020, pp. 429-434.
4. *M. Al-Bassam.* SCPKI: A smart contract-based PKI and identity system // BCC 2017 - Proceedings of the ACM Workshop on Blockchain, Cryptocurrencies and Contracts, co-located with ASIA CCS 2017, 2017, pp. 35–40.
5. *A. Singla and E. Bertino.* Blockchain-Based PKI solutions for IoT // Proceedings - 4th IEEE International Conference on Collaboration and Internet Computing, CIC 2018. IEEE, 2018, pp. 9–15.
6. *W. Jiang, H. Li, G. Xu, M. Wen, G. Dong, and X. Lin.* PTAS: Privacy-preserving Thin-client Authentication Scheme in blockchain-based PKI // Future Generation Computer Systems, vol. 96, pp. 185–195, 2019.
7. *F. Thiel.* Digital transformation of legal metrology – The European Metrology Cloud // OIML BULLETIN VOLUME LIX, 2018.
8. *W. S. Melo, R. C. S. Machado, B. Abreu, L. F. Carmo, and R. Ramos.* Certificac. Digital como Ferramenta de Seguranc , a para Medidores Inteligentes // Anais Estendidos do Simp'osio Brasileiro de Engenharia de Sistemas Computacionais (SBESC). Natal, RN, Brazil: SBC, 2019, pp. 89–94.
9. *W. Melo, L. F. R. C. Carmo, A. Bessani, N. Neves and A. Santin.* How blockchains can improve measuring instruments regulation and control // 2018 IEEE International Instrumentation and Measurement Technology Conference (I2MTC), Houston, TX, USA, 2018, pp. 1-6.
10. *M. Vukolic.* The quest for scalable blockchain fabric: Proof-of-work vs. BFT replication // Lecture Notes in Computer Science (including subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics), vol. 9591, pp. 112–125, 2016.
11. *A. Oppermann, J.-P. Seifert, and F. Thiel.* Secure Cloud Reference Architectures for Measuring Instruments under Legal Control // CLOSER 2016 - 6th International Conference on Cloud Computing and Services Science, vol. 1, no. Closer, 2016, pp. 289–294.
12. *M. Esche and F. Thiel.* Software Risk Assessment for Measuring Instruments in Legal Metrology // Proceedings

of the Federated Conference on Computer Science and Information Systems, vol. 5, 2015, pp. 1113–1123.

Zakharov N.A. Blockchain technology in distributed measuring systems

The design of a distributed measuring system using blockchain technology is discussed. The infrastructure of public blockchain keys is demonstrated and compared with conventional authorization centers. The security of measurements is analyzed.

Keywords: *blockchain, decentralization, distributed measuring system, measuring instrument, legal, legal metrology, security of measurements.*