

Thank you, Ying, for an interesting post on the design and implementation of security technologies. A highlighting point mentioned in the post of traffic encryption is vital to maintain confidentiality, integrity and availability as part of the Zero Trust architecture. Multi-factor authentication (MFA) is extensively developing from single-factor authentication such as password or PIN, two-factor authentication such as one-time passwords and multi-factor authentication such as biometrics, namely face recognition, behaviour and fingerprints. Whilst these are becoming standard practice and greater use by the end-user, there are challenges for operational use (Ometov et al., 2018). Usability is a challenge concerning task efficiency and effectiveness with authentication attempts which can be even more difficult by the uniqueness of the individual as we consider cognitive ability.

Within any MFA framework, considering privacy and security, vulnerabilities could lead to a variety of attacks, and this would need considering in the security design. MFA significantly improves data security; however, issues arise over usability as many security practitioners, designers, and developers find the inclusion a challenge (Das et al., 2019). Therefore we can consider the use of MFA to be in the balance; it undoubtedly allows greater security however, human error can play a part to enable threat attempts such as spoofing and social engineering techniques (Jacomme & Kremer, 2021). The cost of implementation and effort is a far greater reward than compromising confidentiality, integrity, and availability, which is a significant risk for a company.

Das, S., Wang, B. & Tingle, Z. 2019. Evaluating User Perception of Multi-Factor Authentication: A Systematic Review.

Jacomme, C. & Kremer, S. 2021. An Extensive Formal Analysis of Multi-factor Authentication Protocols. *ACM Transactions on Privacy and Security*, 24, 1-34.

Ometov, A., Bezzateev, S., Mäkitalo, N., Andreev, S., Mikkonen, T. & Koucheryavy, Y. 2018. Multi-Factor Authentication: A Survey. *Cryptography*, 2, 1.