Regression Model Building and Efficiency Prediction of Header Compression Implementations for VoIP

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Modern cellular networks utilising the long–term evolution (LTE) and the coming 5G set of standards face an ever–increasing demand for low–latency mobile data from connected devices. Header compression is employed to minimise the overhead for IP–based cellular network traffic, thereby decreasing the overall bandwidth usage and, subsequently, transmission delays.

Albeit both version of Robust Header Compression achieve around 80–90 % gain (see [1] and [2]), neither of these compression designs account for the varying channel conditions that can be encountered in wireless setups (e.g., as a result of weak signals or interference). Specifically, the RFC 5525 for RoHCv2 states that "A compressor always [...] repeats the same type of update until it is fairly confident that the decompressor has successfully received the information." and "The number of repetitions that is needed to obtain this confidence is normally related to the packet loss and out–of–order delivery characteristics of the link where header compression is used; it is thus not defined in this document [RFC 5525]." The impact of these repetitions is closely related to the compressed IP–streams' protocol field dynamics and will differ from application to application.

Our current research efforts try to address this issue by enabling current compressor implementations to configure themselves online, thereby making the compression adaptable to changing channel conditions and various network stream characteristics, which will in turn minimise compression overhead and will pave the way for the adaptation of header compression in IoT scenarios. Our previous efforts target the preliminary analysis of compression utilities and their prediction with linear regression in [3], which has resulted in limited prediction accuracy.

We evaluate various prediction models employing R^2 and error scores next to complexity (number of coefficients) based on an RTP specific training data set and a separately captured live VoIP audio call. We find that the proposed weighted Ridge regression model explains about 70 % of the training data and 72 % of a separate VoIP transmission's utility. This approach outperforms the Ridge and first–order Bayesian regressions by up to 50 % and the second and third order regressions utilising polynomial basis functions by up to 20 %, making it well–suited for utility estimation.

References

[1] M. Tomoskozi, P. Seeling, F. H. Fitzek, *Performance evaluation and comparison of RObust Header Compression (ROHC) ROHCv1 and ROHCv2 for multimedia delivery*, Workshops Proceedings of the Global Communications Conference, GLOBECOM, pp. 1346-1350, 2013.

[2] M. Tömösközi and P. Seeling and P. Ekler and F. H. P. Fitzek, *Performance Evaluation and Implementation of IP and Robust Header Compression Schemes for TCP and UDP Traffic in the Wireless Context*, Engineering of Computer Based Systems (ECBS-EERC), pp. 45-50, 2015.

[3] Máté Tömösközi and Patrick Seeling and Péter Ekler and Frank H.P. Fitzek, *Performance Prediction of Robust Header Compression version 2 for RTP Audio Streaming Using Linear Regression*, European Wireless 2016 (EW2016), 2016.