This thesis describes our improvement of machine translation (MT), with a special focus on the English-Czech language pair, but using techniques applicable also to other languages. First, we present multiple improvements of the deep-syntactic system TectoMT. For instance, we implemented a novel context-sensitive translation model, comparing several machine learning approaches. We also adapted TectoMT to other domains and languages. Second, we present Transformer – a state-of-the-art end-to-end neural MT system. We analyzed in detail the effect of several training hyper-parameters. With our optimized training, the system outperformed the best result on the WMT2017 test set by +1.0 BLEU. We further extended this system by utilization of monolingual training data and by a new type of backtranslation (+2.8 BLEU compared to the baseline system). In addition, we leveraged domain adaptation and the effect of “translationese” (i.e. which language in parallel data is the original and which is the translation) to optimize MT systems for original-language and translated-language data (gaining further +0.2 BLEU). Our improved neural MT system significantly (p<0.05) outperformed all other systems in English-Czech and Czech-English WMT2018 shared tasks, in terms of both automatic and manual evaluation. It was even significantly better than the human reference translation according to the manual evaluation.