The Node-Capacitated Clique (NCC) is a new model for distributed communication introduced by Augustine et al. in Distributed Computation in Node-Capacitated Networks [SPAA '19].
Due to its recent introduction, many questions regarding it are still unanswered.
In this thesis, we study how to solve local problems in the Node-Capacitated Clique, by studying the example of the Minimum Dominating Set problem. Additionally, we start to derandomize the communication primitives and other techniques from its introductory paper.

For the first topic, we present two algorithms for the MDS problem.
The first is an $O(\log n)$-approximation that runs in $O(\log n \log \Delta(a+\log^2 n))$ rounds and the second is an $O(a^2)$-approximation that runs in $O(\log n (a+\log n))$ rounds.
Afterwards, we present a technique to solve a problem on multiple subgraphs in parallel and merging the results. Naturally, this is easy for the MDS problem and we use the technique together with the $O(a^2)$-Orientation to obtain a third MDS algorithm, with approximation ratio $O(a \log^2 n)$ and time requirement $O(\log n (a+\log n))$.

For the second topic, we offer a deterministic version of the Aggregation Algorithm, which is one of the Node-Capacitated Clique's communication primitives.
It takes $O(l_1+L/n+l_2 L/(n \log n)+\log^2 n)$ rounds to terminate.
Afterwards, we describe a naive, deterministic version of the Orientation Algorithm, which was also presented in the original NCC paper.
This algorithm has a runtime of $O(\Delta \bar{d}+\log^3 n)$.
Finally, we use the newly created techniques to present a scheme to simulate any CONGEST algorithm in the NCC with overhead $O(\Delta^2 \bar{d}/\log n+\Delta \log^2 n)$.
This allowed us to offer a deterministic $O(\log \Delta)$-approximation for the MDS problem that runs in $2^{O(\sqrt{\log n \log\log n})} * O(\Delta^2 \bar{d}/\log n+\Delta \log^2 n)$ rounds.