Group communication services, and especially those that implement Virtual Synchrony semantics, are powerful middleware systems that facilitate the development of fault-tolerant distributed applications. In this thesis, we present a high quality, theoretical design of a group communication service that implements Virtual Synchrony semantics and is aimed for deployment in wide-area networks (WANs). The design features a novel algorithm for implementing Virtual Synchrony semantics; the algorithm is more appropriate for WANs than the existing solutions because it involves fewer rounds of communication and operates in a scalable WAN-oriented architecture. The high quality of the design refers to the level of formality and rigor at which it is done: The design includes formal and precise specifications, algorithms, correctness proofs, and performance analyses. We develop the necessary supporting theory and methodology required for producing and evaluating this design. In particular, we develop a formal, inheritance-based, methodology that supports incremental construction of specifications, models, and proofs. This methodology helps us manage the complexity of the design and makes it evident which part of the algorithm implements which property of the system. We also develop new, formal approaches in the area of performance evaluation.