Many scientific applications are data-intensive. It is estimated that organizations with high end computing infrastructures and data centers are doubling the amount of data that they are archiving every year. Harp extends MapReduce, enabling HPC-Cloud Interoperability. We show how to apply Harp to support large-scale iterative computations that are common in many important data mining and machine learning applications. Further one needs additional communication patterns than those made familiar in MapReduce. This leads us to the Map-Collective programming model that captures the full range of traditional MapReduce and MPI features, which is built on a new communication abstraction, Harp, that is integrated with Hadoop. It provides optimized communication operations on different data abstractions such as arrays, key-values and graphs. With improved expressiveness and performance on collective communication, Hadoop/Harp can do in-memory communication between Map tasks without writing intermediate data to HDFS, enabling simultaneous support of applications from HPC to Cloud. Our work includes a detailed performance evaluation on IaaS or HPC environments such as FutureGrid and the Big Red II supercomputer, and provides useful insights to both frameworks and applications.