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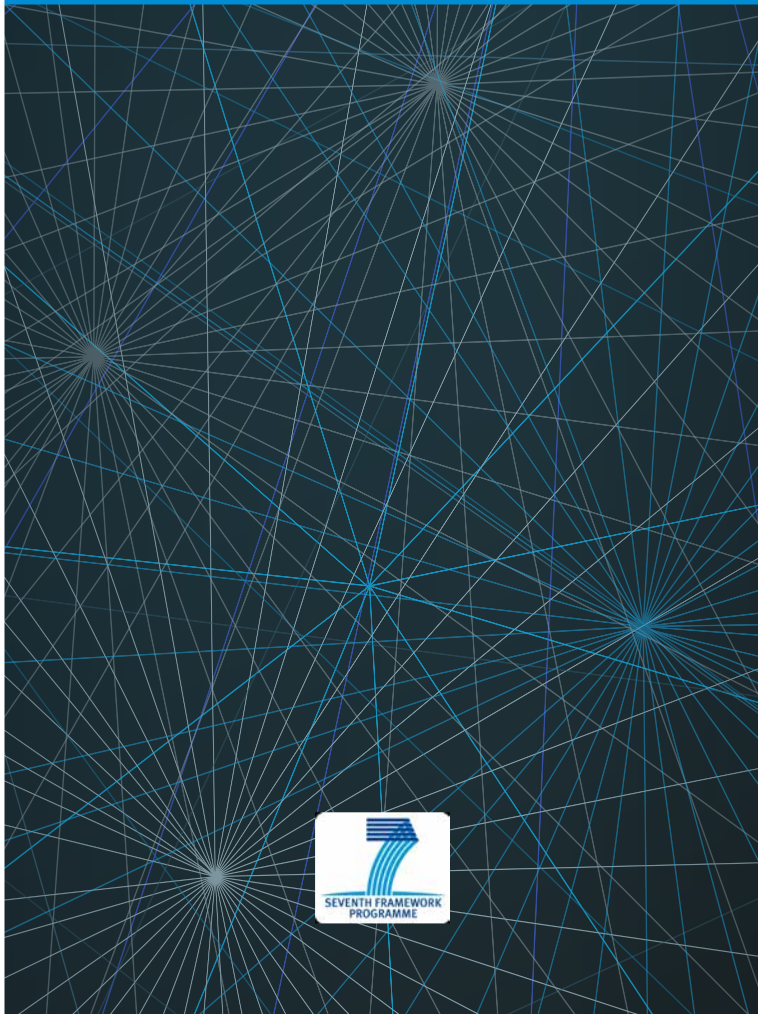
LIFT

USING LOCAL INFERENCE IN MASSIVELY DISTRIBUTED SYSTEMS



SEVENTH FRAMEWORK PROGRAMME

LIFT

USING LOCAL INFERENCE IN MASSIVELY DISTRIBUTED SYSTEMS

Knowledge processing in a distributed and dynamic world

As both the scale of today's networked systems, and the volumes and rates of the associated data streams continue to increase, the analysis of their global phenomena becomes increasingly difficult due to the continuous production of streams of data scattered among distributed, possibly resource-constrained nodes, and requiring reliable resolution in (near) real-time.

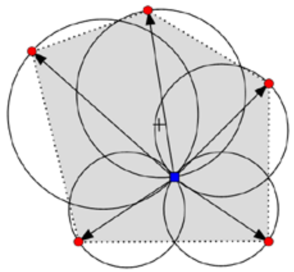
Overall objective

LIFT will enable the efficient and effective detection of changes in very large distributed data streams where it is impossible or ineffective to accumulate all data into a single place.

The Lift project is funded by the FET-Open (Future and Emerging Technologies) unit of the European Commission within the 7th Framework Programme under grant no. 255951, FP7-ICT-2009-C.

The LIFT approach

We will explore a novel approach for realizing sophisticated, large-scale distributed data stream analysis systems, relying on processing local data in situ. Our key insight is that for a wide range of distributed data analysis tasks, we can employ novel geometric techniques for intelligently decomposing the monitoring of complex holistic conditions and functions into safe, local constraints that can be tracked independently at each node (without communication), while guaranteeing correctness for the global-monitoring operation. While some solutions exist for the limited case of linear functions of the data, it is hard to deal with general, non-linear functions: in this case, a node's local function value tells nothing about the global function value. Our fundamental idea is to design novel algorithmic tools that monitor the input domain of the global function rather than its range. Each node can then be assigned a safe zone (SZ) for its local values that can offer guarantees for the value of the global function over the entire collection of nodes. This represents a dramatic shift in conventional thinking and the state-of-the-art. A second approach is to maintain only concise summaries of the locally-observed data streams. The summaries reduce memory requirements and are subject to probabilistic guarantees for the approximation of the global value. Thus, we aim to reduce the amount of communication and data collection across nodes to a minimum, requiring nodes to communicate only when their local constraints are violated. Privacy protection, in case that the transmitted data contains sensitive information, is also revolutionized in our view.



Scenarios

We investigate real-life scenarios from network health monitoring, large-scale analysis of human mobility and traffic phenomena, internet-scale distributed querying, monitoring sensor networks, and stock market bubble detection. The scenarios will demonstrate the theoretical and practical viability of the LIFT approach.