

# Process Query Systems

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**ABSTRACT:** Process Query Systems (PQS) are a new kind of information retrieval technology in which user queries are expressed as process descriptions. The goal of a PQS is to detect the processes using a datastream or database of events that are correlated with the processes' states. This is in contrast with most traditional database query processing, information retrieval systems and web search engines in which user queries are typically formulated as Boolean expressions.

Many applications of current interest involve using databases or datastreams of events to detect instances of processes. In those applications, events provide evidence that is used to infer the existence and estimate the states of the various processes of interest. Examples of such applications include: network and computer security; network management; sensor network tracking; military situational awareness and; critical infrastructure monitoring and protection.

In this work, we have adopted the thinking of modern systems and control theory (including such areas as communications, speech recognition and other areas that use Hidden Markov Models for example) in which processes have "internal" or "hidden" states that are not always externally observable. The processes' hidden states generate observable events from which we seek to infer the existence of the processes and estimate the hidden states of the instantiated processes as observable events are collected.

The algorithmic elements of PQS include: Viterbi algorithms, Kalman filtering, multi-target tracking, content-based routing, and a variety of new detection and estimation algorithms for "weak" models of dynamical systems.

We will outline the main features of Process Query Systems and the technical challenges that process detection entails. Furthermore, we present several important application areas that can benefit from PQS technology. Our working prototype of a PQS, called TRAFEN (for TRACKing and Fusion ENgine) is described as well.

## Background reading:

<http://actcomm.dartmouth.edu/~jiang/pqs.pdf>

<http://actcomm.dartmouth.edu/~jiang/tsdecns.pdf>

<http://actcomm.dartmouth.edu/~jiang/system.pdf>

**Biography:** George Cybenko is the Dorothy and Walter Gramm Professor of Engineering at Dartmouth. His current research focuses on detection and estimation of multiple processes in datastreams derived from sensor networks and databases. He is an IEEE Fellow. Cybenko's degrees are from the University of Toronto (BSc Mathematics 1974) and Princeton (PhD Mathematics 1978).