



# Cogility Software's Unique Hierarchical-Complex Event Processing Solution

## Overview

---

An event is anything that happens and can be recorded<sup>1</sup>. The volume of event data—personal and professional—is already overwhelming current technical systems, and continues to increase. Interaction compounds the level of complexity. If harnessed, however, this ocean of non-sequential communication reveals patterns of behavior which provide critical insight.

Hierarchical complex event processing [H-CEP] is intended to harness this phenomenon and provide the means for the enterprise to be more informed, responsive and able to anticipate change. H-CEP enables this by capturing events and mapping the events to defined or hypothesized behavioral patterns (in a geo and temporal context). In the process, it quickly weeds out data and events that fall outside these patterns. Additionally, an analyst is not tied to a single pattern to meet a specified mission or goal: analysts can formulate any number of behavioral pattern hypotheses, thereby greatly increasing the likelihood of anticipating and predicting imminent behavior.

This is one of the fundamental strengths of H-CEP. The ability to define patterns of behavior is a powerful predictive tool: once the patterns begin to

reveal themselves, the next steps can be assigned levels of probability. This in turn triggers enhanced observation, and enables the opportunity to intervene, leverage the insight, or conversely, to prevent, or mitigate negative outcomes.

Cogility's unique H-CEP is fundamentally distinct from other forms of CEP, such as streaming, rule-based and stateful CEP. These are limited to one or a very few event types, and are purely "after the fact" and reactive. Streaming CEP, for example, is very useful for analyzing streaming (near continuous) single type of event traffic, such as tracking the price of a specific stock and determining whether to perform a buy or sell function.

In contrast, H-CEP processes multiple event types from multiple sources that are not necessarily well-behaved, meaning that the events do not arrive in perfect order. Some of the expected events might not be captured at all, and the specified behavioral patterns may take days, weeks or months to mature. Therefore, H-CEP is best used to address complex social behavior and to predict targeted opportunities or occurrences. This enables analysts to leverage the power of automation by focusing limited manpower resources on the most critical and time -sensitive tasks.

---

<sup>1</sup> Event Processing, Designing IT Systems for Agile Companies, K. Mani Chandy and W. Roy Schulte, 2010

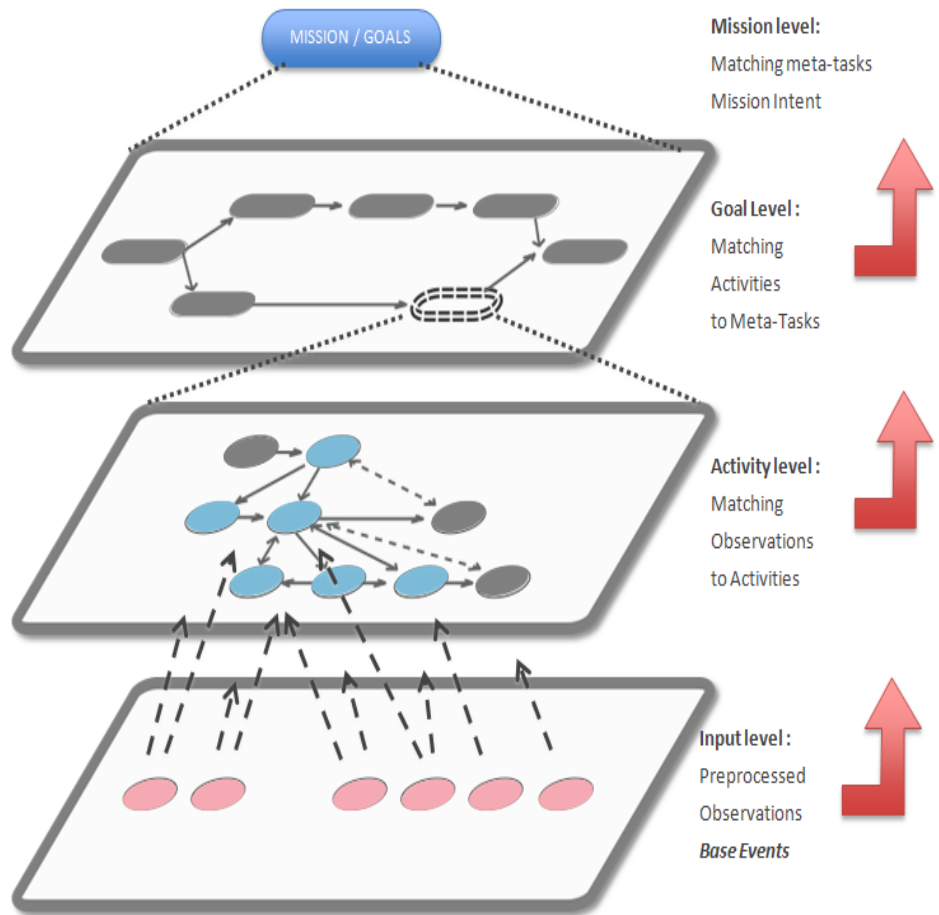
## H-CEP and How It Works

Cogility's H-CEP is a state-based computational hierarchy of templates that defines patterns of behavior, where the root template defines the goal or mission of the client, customer or adversary.

The leaf level of the H-CEP template hierarchy groups, filters, and matches available (base) event types such as social media (Twitter), email, web crawling, voice to text, face recognition, etc., to steps within the template(s) structure. H-CEP processes event information from the bottom up, and continuously attempts to correlate all information available. These template steps are arranged in a logical flow, and once the template logic is successfully achieved [meets a pre-specified measure], the combined set of events yields a new, higher-level event type representing the combined meaning of the lower level events.

The key is that human analysts, or subject matter experts, initially deduce likely behavioral patterns based on common investigative heuristics: typically, multiple pattern hypotheses are derived. H-CEP then crunches away at all the event traffic and notifies the analyst or investigator when template patterns are maturing and require further attention.

Figure 1 is a depiction of the H-CEP approach, starting from the bottom of the hierarchy where base events (observations) are received, grouped and matched to one or more templates. This process results in new derived observations (which are abstractions with higher level meaning): this successively continues up the hierarchy until the goal or mission is achieved.



**Figure 1. H-CEP Bottoms-Up Matching Process**

As this hierarchy populates with events, the analyst knows in advance the likely goal, and therefore the likely steps needed, to achieve or prevent the goal. In this context, H CEP provides a predictor for future behaviors.

## Conclusion

---

Cogility Software asserts that H-CEP is an essential automation tool and force multiplier for decision support, equally applicable to businesses and to investigators dealing with the most difficult threat scenarios. These indicators are often disconnected either geographically or temporally, or both. Through Hierarchical CEP they can be captured and placed in context for human consumption, and proactive decision-making.

Cogility's H-CEP will achieve 2 critical business drivers: (1) reduce the time to attain actionable intelligence, (2) allow decision makers to better utilize executive, analytical and investigative resources based on highly qualified CEP generated leads.

Cogility's H-CEP ability to define hypotheses is unbounded, limited only by the imagination. It is expressed in an easy to learn templating language, which sifts through all indicators and combines and matches input to identified patterns. H-CEP provides the most effective means of enabling proactive action.

**Cogility Software Corporation**  
**47 Discovery, Suite 170**  
**Irvine, CA 92618**  
**p. 703 655-5827**  
**f. 949 398-0015**  
**[info@kogility.com](mailto:info@kogility.com)**  
**[www.kogility.com](http://www.kogility.com)**