Chapter 4
Temporal Perspectives in Event Processing

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ABSTRACT
One of the major characteristics of event processing is its strong relationship to the notion of time, yet some of the temporal aspects of event processing still issue challenges to the implementations of event processing tools. This paper provides an overview of the notion of “event processing network” as the underlying model behind event processing; maps the temporal aspects, and discuss each of them. The temporal aspects that are discussed are: temporal dimensions of events, time granularities, temporal context, temporal patterns, event order, and retrospective and proactive operations.

INTRODUCTION
Event Processing is an emerging area in the IT industry, evident by the burst of products, and attention given by analysts, venture capitals and enterprises. One of the notable characteristics of event processing is its close relation to temporal aspects. One can view event processing as getting a decision that is based on looking at the history of transitions in the domain of discourse. This glance on the event history involves multiple aspects of temporal operations; In this section we’ll explain briefly the main concepts and architecture of event processing, and show the touch points between event processing and temporal aspects, the rest of the paper will deal in details with the various issues.

Introduction to Event Processing
Event denotes something that happens in reality (Luckham, 2002). While data-item typically denotes the state of some entity, events denote transition between these states. There is a semantic overload in the term “event”, since it reflects both the event occurred in the reality and its representation in the computer domain (event message or event object). Event is being processed by the
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means of “event processing network” (Sharon, 2008).

The life-cycle of event processing application is detailed below (some of it in iterative way):

1. Event schemas are defined.
2. Event producers devise mechanism to emit events: in push, periodic pull, or on-demand pull. Event producer examples are: instrumented program, state observer in business process management system, sensors.
3. The event is published on a channel and routed through an “event pipe” to one or more “event processing agents” which – validate, transform, enrich, filter or detect patterns and create more events that are in turn published on another channel and routed to more event processing agents.
4. At the edge of the event processing network the created events called “situation events” and are routed to “event consumers”

Figure 1 shows an EPN example, for a monitored patient in the hospital.

Event producers are:

- Admittance office that records admittance and release of patients.
- Blood pressure meter
- Fever meter

Agents are performing: filtering, aggregation, enrichment, transformation and pattern detection; routing channels are designated in r1… r9 and event pipes are designated in p1… p20. We shall use this patient monitoring simple example to demonstrate all concepts. The patterns that need to be detected are:

- **Ascending Fever**: Fever of more than 39 degrees Celsius is consistent over three hours and is constantly ascending, this is calculated every three hours – in 00:00, 03:00, 06:00, 09:00, 12:00, 15:00, 18:00, 21:00.
- **Hypotension**: The average systolic blood pressure over three consecutive measurements is less than 85
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