

Integrated Modeling of Statics & Dynamics: Integrating Data and Processes

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Abstract

In order to completely specify the functionality of an information system, it is not enough to model only the structure of its data (*statics*), or to model only its processes (*dynamics*), or to model both its statics and its dynamics in isolation. The statics and the dynamics are *interdependent* ('the two sides of the same coin'): each constrains and shapes the other. Therefore they cannot be specified independently from each other: their interdependencies must be modeled as well. The *interdependencies* and *integration* of the statics and dynamics should be modelled too. Both *States* and *Actions* are first-class citizens. The tutorial concentrates on the Functional Requirements of the system, not on its Quality Requirements.

Keywords

Statics, Dynamics, Data, Processes, Requirements, Integration, Functional Specification,

About the Presenter

Bert de Brock is full professor emeritus in Business Information Modelling at the University of Groningen. He received a M.Sc. in Mathematics at the University of Groningen and a Ph.D. in Computing Science at the University of Technology in Eindhoven in 1984.

From 1985 to 1990 he worked at Philips Research on a generic Parallel Inference and Storage Machine and on a generic workflow system (Electronic Case Handling in Offices).

In 1990 he and a former colleague started a company in the areas of IT-consultancy, post-academic education, and analysis, design, and construction of (tailor-made) information systems for customers. He not only has a solid theoretical background, but over the years he also gained much practical experience (in several roles). Moreover, he taught on developing databases and information systems (in the broadest sense) to a variety of student groups as well as to professionals working in the field.

His research (and educational) interests include databases, information systems, software engineering, and bioinformatics. He is the author of several textbooks, e.g., [1].

Goals and Objectives

The overall goal of the tutorial is to concretely and practically answer the central question: *How to construct an integrated, coherent, and complete functional specification of the statics & dynamics of an information system?* Other concrete learning outcomes (skills): Designing understandable, structured process diagrams, annotating process diagrams with states and outputs, tuning process and state descriptions, and generating process diagrams from textual representations.

Intended Audience

- Data-oriented people who want/need to integrate data with the processes (the dynamics)
- Process-oriented people who want/need to integrate processes with the data (the statics)

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In general, the tutorial is aimed at researchers, educators, and practitioners in conceptual modeling and information systems design who want a principled way to reason about how data and behavior fit together.

No prior familiarity with the presenter's work is assumed; a basic background in modelling is sufficient.

Relevance and Novelty

Many approaches to specify the functionality of an information system only look at its *statics*, making use of notions such as Data Model, Class Diagram, Entity-Relationship Model [2], Object-Role Model (ORM, [3]), etc. Indeed, knowing the statics is usually enough to do retrieval (formulating queries). On the other hand, many approaches to specify the functionality of an information system only look at its *dynamics* [4], making use of notions such as Business Process Model and Notation (BPMN, [5]), Activity Diagram [6], etc. However, most existing languages for modelling information systems focus either on one or on the other [7]. The *data*? 'That sorts itself out' is often said, or is at least the attitude, by many process-oriented people. Conversely, the *operations* on the data? 'That sorts itself out' is often the attitude of many data-oriented people.

The *mutual interaction* (interdependencies) between the statics and dynamics should be specified too, because their specifications influence each other, usually even in a very subtle way. The statics and the dynamics are interdependent; therefore they cannot be specified independent from each other. Any transition (so, *dynamics*) necessarily changes the state (*statics*) of the system. For example, which data (statics) should exactly be registered during *Register Order* (*dynamics*)? Well, that depends on the (required and optional) Order attributes in the data model. And the action *Close Order* might only be applied when the order has status 'Fulfilled' (*statics*). So, also the *interdependency* of the statics and dynamics must be modelled. Hull et al [4] note that traditional approaches to Business Process Management (BPM) focus primarily on the process aspects, and treat the persistent data accessed and manipulated by the business processes as second-class citizens. However, the statics and dynamics of a system are in fact 'the two sides of the same coin' [8]. In other words, both *States* and *Actions* are first-class citizens.

Given the shortcomings of developing the statics only, the dynamics only, or the statics and the dynamics in isolation, and so the necessity of an *integrated* functional specification of the statics & dynamics of an information system, this novel tutorial – based on recent research – teaches you how to construct a coherent and complete functional specification of the statics & dynamics of an information system in an integrated manner.

Projected Benefits

In this tutorial, the participants will learn a practical, *integrated* approach to clearly and completely specify the statics & dynamics of an information system, including their interdependencies, in a coherent way. The tutorial provides both the underlying theory as well as some concrete, illustrative examples. The theory combines a variety of modeling methods (among others [2, 5, 6]) and is based on recent theoretical and practical work of the author [9, 1].

As indicated, other knowledge and skills that participants will gain: Designing understandable, structured process diagrams, annotating process diagrams with states and outputs, tuning process and state descriptions to each other, and generating process diagrams from textual representations.

Participants can put forward their own cases.

Outline

Participants will be introduced to an integrated approach for specifying the statics, the dynamics, and their mutual dependencies within a single coherent framework. The tutorial is structured in three parts:

1. Introducing, illustrating, and elaborating the problem: We motivate the need for integration by examining what goes wrong when statics and dynamics are specified separately
2. Theoretical background: We present the underlying theory, which contains ideas from (mathematical) logic, data modelling, automata theory, and the semantics of programming languages, and builds on the presenter's earlier work
3. Finally, we work through concrete, illustrative examples step by step so that participants can see how the approach is applied in practice

The tutorial follows more or less [9].

Tutorial Method

A variation of lectures, guided exercises, demos, and participants' own cases.

Declaration on Generative AI

The author has not employed any Generative AI tools.

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