

Objects, Processes and the Colours of the Rainbow: Towards a Conceptual Model for Object-centric Processes

Ekkart Kindler

Technical University of Denmark, Kgs. Lyngby, Denmark

Abstract

In recent years, process science has moved away from the traditional “case-centric” view of business processes to the “object-centric” view. This view has been quickly adopted by many companies and researchers, in many different shapes, forms and interpretations of what an object actually is.

When discussing the object-centric approach, it is not always clear whether or to which extent the different parties have the same concept—or in the least a similar concept—in mind when using the same words and terms. And the classical notion of a case as an instance of a process often gets completely lost in translation.

To foster a discussion of what we mean when we refer to objects, processes and cases in the context of process mining, process science and business process management, this paper discusses the motivation behind the move towards the “object-centric” view and presents a conceptual foundation for this discussion. This way, we hope to, eventually, reconcile the traditional “case-centric” view and the “object-centric” view.

Keywords

Object-centric processes, Case-centric processes, Conceptual model

1. Introduction

In recent years, processes science has moved away from the traditional “case-centric” view of business processes to the “object-centric” view of business processes, which was most prominently introduced by Wil van der Aalst [1]. And this view has quickly caught on with many companies and researchers. And even though van der Aalst’s presentation [1] has been quite clear, the notion of “object” took many different shapes, forms and interpretations.

When discussing the object-centric approach, it is not always clear whether or to which extent the different parties have the same—or in the least a similar—concept in mind when using the same words and terms. And the classical notion of a case as an instance of a process often gets completely lost in translation, even though the notion of a case is fundamental for understanding the concept of a process [2]: no cases, no process!

To foster a discussion of what we mean when we refer to objects, processes and cases in the context of process mining, process science and business process management, this paper discusses the motivation behind the move towards the “object-centric” view and, based on that, introduces a conceptual foundation for this discussion.

2. Motivation

Even though the motivation of this paper is to remind the process science community of its origins in business process management and the clear-cut notions of processes and cases, the motivation of this paper is not to get rid of the “object-centric” view of business processes. When van der Aalst introduced the “object-centric” view on processes [1], there were good reasons to do so. In this paper, we will show, however, that the “object-centric” view and the “case-centric” view can be reconciled by providing the right terminology and a conceptual model for all the involved concept. What is more, this conceptual

ATAED 2026: Algorithms & Theories for the Analysis of Event Data, Satellite Event of Petri Nets, June 2026, Hamburg, Germany

✉ ekki@dtu.dk (E. Kindler)

ORCID [0000-0003-3895-6297](https://orcid.org/0000-0003-3895-6297) (E. Kindler)



© 2026 Copyright for this paper by its authors. Use permitted under Creative Commons License Attribution 4.0 International (CC BY 4.0).

model might help resolving some prominent issues in object-centric processes, called convergence and divergence [3].

In the traditional case-centric understanding of business processes, a *case* is a single instance or execution of a *process*. And already at this point, two important questions pop up:

1. What comes first, the process or its execution, the case?
2. And, can a case exist without its process?

The answer depends very much on whom we would be asking these questions. Someone working in workflow management systems (WfMS), might probably say that the process needs to be modelled first (presumably in a workflow management system), and then the workflow management system would be used to execute (or in WfMS terminology “enact”) a first case of this process. But, some others might claim that the process that now is defined and can be enacted by the WfMS had been already executed before in some company without any IT just using paper. So, the case came before the process actually was formally defined or modelled in the WfMS.

And, there is another subtlety that is hidden in the above questions. What does it mean for a process to exist? Does the “existence of process” imply the existence of a fully fledged process model? Or is some loose understanding or even just “having a name” for that process, which somehow characterizes the collection of the executions that we are interested in, already enough for the “process to exist”? This latter view might be taken by people using some case management systems, which collect all relevant information of a case without the underlying processes being modelled explicitly. But, granted, having a case management system for these cases indicates that someone must have had the insight that there is something which constitutes such cases, and this insight can be considered as acknowledging the existing of such a process, the cases of which need to be taken care of.

Independently of what your first intuitive answers to the two questions above might have been, a slightly closer look and discussion shows that the converse answer might also have some truth to it, and that there is a complete spectrum of answering these and related questions. One extreme end of the spectrum might be the traditional WfMS approach, where processes are first modelled and then enacted; the other extreme end might be cognitive approaches for humans to make sense out of what is going on in a complex system (or even system of systems): processes are a way to provide structure and abstractions that help humans understand what is going on in a complex system. And the choices concerning the level of abstraction and what aspects to consider will very much depend on the respective persons and the stakes they have in the respective system. And everything in between these two extremes might also make sense.

Not surprisingly, the “object-centric view” to processes came from the area of process mining, where there are a whole lot of observations on what is going on in some system (typically called an event log) and where the goal is to make sense of what is going on by identifying cases and what the underlying process is by mining a process model from the observations. In traditional process mining, the cases are assumed “to be there” already in the observations in form of some case IDs—or the case IDs will be produced by some form of pre-processing.

But, in many real-world situations, identifying what the cases should be for a certain purpose, which level of detail needs to be considered and, actually, which different processes might be relevant will not be known upfront. In these situations, it is not clear upfront what the cases are, what the respective case IDs might be and how to identify what parts of the log belong to which cases. Therefore, in the “object-centric” view, everything that might be relevant for “something” is considered to be an “object” from the outset; some objects might turn out not to be relevant for anything later, other objects might turn out to be relevant for more than one thing. And it is part of the process mining to identify and tell this from each other.

3. Colours of the rainbow

When motivating the object-centric approach to processes, van der Aalst [4] used the metaphor of Rainbow Spaghetti Models for indicating that there are different types of processes, which are all going

on at the same time in an intertwined way—where the colours represent the different types of processes. Here, we take the metaphor of the rainbow one step further by asking: “How many colours has a rainbow?” Sir Isaac Newton famously answered this question with “seven”, even though he admittedly could not discern all of these seven colours himself; and the number “seven” was obviously motivated by some of his beliefs rather than what he could perceive himself. And from the physics point of view, one might even argue that the rainbow consists of an infinite spectrum of wavelengths; colours are just the human perception of what wavelength (or some combination of wavelength) humans in general or individually can, want or need to perceive or discern as different in some context or for some purpose.

And this, from my point of view, is the main motivation of the object-centric approach: Let’s deal with the full spectrum of all wavelengths in some system as objects; which of them are perceived as the same type of object (in the metaphor of the rainbow: perceived as the same colour) is a matter of the purpose, the level of detail and the aspects and concerns of some person or stakeholder who needs to make sense of all these objects and what is going on with them. These are different for different stakeholders and might even change over time for the very same stakeholder. In short, the reality might be the same, the perception of the reality and how we structure it in order to make sense of it might be very different.

To accommodate for these different perceptions of the very same reality, we need to have a conceptual model that, on the one hand, contains everything about what is going on in a system; and on the other hand, this model must allow different stakeholders to select, arrange and group that information about reality into their own perception: into cases and processes according to their goal and perception of what is relevant for them.

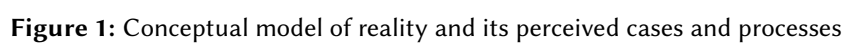
4. Conceptual model

In our conceptual model, we keep the basic information on what is going on in the real world (or the part of the real world that is reflected in an IT-system) separate from the individual perceptions of what is going on. The basic information on reality might already have its own data and object model and also contain events and models for the different event types. The perception of what belongs together as a case of some process is just pointing out what is perceived to belong to a case of some process, and there is no limit on using the same thing occurring in reality belonging to different cases of the same type of process or even different ones. This way, different perceptions of the same basic information are not interfering with each other; we do not even need to copy the things of the real world occurring in different perceptions, and we do not need to delete things that are not perceived as part of any process from the reality. Processes and cases are just a perception of reality, and a way to group and aggregate the basic information (without changing or modifying it).

Figure 1 shows this conceptual model. In the center in green, it shows the reality, which are the *objects* and actually the different versions of each object over time as well as some *events* associated with these objects. The events can be anything, which is recorded or logged by some IT-system, which might have meaning for some process engineer or scientist or not. Around it, at the top, to the left and to the right shown in blue, the diagram shows the model information.

The green and blue parts are the “reality”. The blue parts are the model or type information, the green part are the instances. Note that by making the different versions (or snapshots) of the objects explicit, this conceptual model reflects the evolution of “reality” over time. Note that the conceptual model even allows the type of an object to change over time. But this as well as many other details are subject for discussion, and might not be relevant in many settings at all. We added this to our conceptual model just to point out that such aspects can be reflected in such a conceptual model. And the conceptual model assumes that events and object versions and their types (once they exist) never change! The evolution over time is reflected in new versions and new objects and new events over time; once they exist, they do not change anymore (the very nature of a log). But, we do not go into a detailed discussion of this in this paper either.

At the bottom, the diagram shows the perception of the reality: the instance information is shown in



orange, which are the *business objects* (*cases*) and its *business events* (where the attribute "business" for objects and events indicates that they have some meaning in the domain). The business objects refer to the relevant objects of the reality; and the business events can refer to the underlying events of the reality. Note that also this could be slightly more elaborated in the sense, that also the business object could refer to events and the business events could refer to objects. Again, the details would be up for discussion.

The type information concerning the business objects and business events are represented in purple. Here, we used our own very traditional view of business processes from the AMFIBIA model [5]: A process (model) consists of tasks (types of activities), and a case can be broken down to activities. But, here we are slightly more general in that a task or a process is considered a process again; and the same applies to activities: an activity of a case can be a case again, recursively. Again, this is up for discussion.

And there are a lot of more details, which can and should be discussed. The most important aspect here is that the perception (purple and orange parts) of the reality (blue and green parts) is just adding structure without interfering with reality. And this way different perceptions do not interfere with each other; or they only interfere, if someone choses to do so.

This conceptual model should reflect the traditional process mining approach: making sense of reality. But, it is not limited to that, the conceptual model would not prevent someone from making process models, which drive the execution of a process in the real world, creating new instances of objects and events, even making new object types and event types and creating new events and new versions of objects.

In this paper, we do not include models for life-cycles of objects or included process models. The focus is on the information on what is going in reality in terms of data, versions of objects and events. But these could, added to the model in a similar way our AMFIBIA approach [5] at some later point.

5. Conclusion

In this paper, we have presented a conceptual model of object-centric processes which without losing the concepts of cases and, therefore, reconciles the "object-centric" with the "case-centric" view of processes.

Many details can and should be debated, discussed and maybe changed. Anyway, the way in which this model is structured and the principles behind should demonstrate that "object-centric" and "case-centric" do not need to be in contradiction.

Declaration on Generative AI I have not employed any generative AI tools for creating material or text presented in this paper and, for better or for worse, take full responsibility for the content and wording of this paper. I am very grateful though, for tools like Overleaf and its built-in spell-checker, which greatly helps keeping the eye on the ball.

Acknowledgements I am even more grateful for friends and colleagues, who found time to discuss some of the issues presented in this paper with me; this way, they helped shape my thoughts on object-centric processes. I would like to thank the members of the Software Systems Engineering Section at DTU Compute, who endured several of my talks and rants on "object-centric" and who discussed with me earlier versions of the model presented in the paper. I would also like to thank the anonymous reviewers of this paper for their attentive reading, their thoughtful comments and suggestions on its contents (and for spotting and pointing out several typos).

References

- [1] W. M. van der Aalst, *Process Mining: Data Science in Action*, Springer, Heidelberg, 2016.
- [2] E. Kindler, BPM to Process Mining 2.0: “Can we have back our cases, please?!”, in: BuzzOs Workshop at ICPM, Technical University of Denmark, Kgs. Lyngby, Denmark, 2024.
- [3] W. M. P. van der Aalst, Object-centric process mining: Dealing with divergence and convergence in event data, in: P. C. Ölveczky, G. Salaün (Eds.), *Software Engineering and Formal Methods*, Springer International Publishing, Cham, 2019, pp. 3–25.
- [4] W. M. van der Aalst, Rainbow spaghetti, metro maps, and object-centric process mining, 2023.
- [5] B. Axenath, E. Kindler, V. Rubin, AMFIBIA: A meta-model for the integration of business process modelling aspects, *International Journal on Business Process Integration and Management* 2 (2007) 120–131.