How service providers can utilize process mining on customer journeys to gain actionable insights for service delivery improvements

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Abstract. Companies offer help and service to their customers through different channels and touchpoints. To keep track of their customers' needs and preferences service providers need to measure both overall experience and deviations in the service delivery process. This paper describes experiences from combining process mining and customer journeys in two business cases, both from the operations of a major telecom provider. It was found that the designed customer journeys often result in unintended deviations for 10–25% of customers. Moreover, adding an additional step in the form of an SMS notification into the designed journey was found to have a significant effect. This simple step reduced the amount of customer service inquires and lowered the rate of deviations. Finally, by using process mining on trace data from IT systems, it was possible to quantitatively and systematically map the customer journeys, gain actionable insights for specific channels, and identify possible pain points causing traffic that impedes customer support.

Keywords: Customer journey, process mining, event logs, service delivery

1 Introduction

Today, organizations operate in a world of volatility, uncertainty, complexity and ambiguity. The telco industry is facing several challenges, such as technological shifts, declining revenues, and growing competition [1]. A fast-changing environment and uncertainty are placing new demands on organizations and their ability to utilize available data to create value and improve their processes [2]. Although many companies focus on cost reduction and revenue growth, it is becoming more important to understand customers' needs and keep them satisfied by utilizing new sources of data and analytics. Customers' expectations are not constant; they change with evolving technologies. In the telco industry, acquiring customers costs five to six times more than retaining

existing customers [3]. Therefore, it is not surprising that companies are becoming more and more customer centric.

To meet the digital demands imposed by industry norms, many companies invest heavily in self-service solutions to automate their processes. For many customers, this means zero contact with a service provider representative. It is argued that the psychological aspects of adapting to self-service solutions are linked to the previous social relationships a customer has had with a company [4]. By switching to self-service solutions, companies expect gains in efficiency, but it is conceivable that some customers may experience feeling a loss of uniqueness and the lack of a personal relationship with a company, which can offset the positive gains achieved from automatization. Consequently, it is even more important to use data to study customer journeys to gain insight about pain points, preferences, and usage patterns. This provides valuable information about which customers prefer digital channels and which need personal attention.

Improving the customer experience (CX) is an area where it is possible for a company to differentiate itself in the marketplace with relatively low capital investments. In a recent Forrester report [5], the potential benefits from improved CX were shown to be increased customer retention, higher cross-sell and upsell potential, more new customers, and decreased cost to serve. A solution for designing excellent CX lies in analyzing and deeply understanding customer journeys, i.e., to describe services from the customer's point of view [6,7]. It has been argued that the customer journey approach represents a paradigmatic shift in how organizations understand a customer's experience of a service [8].

The digital shift and emergence of self-service platforms has given rise to big data, which creates new possibilities for value creation. However, it also creates challenges related to analyzing and structuring the data. In the telco industry, there are many generated events, such as calls, messages, and network information, but also click data from digital self-service channels (i.e., apps and web solutions). The data can be used to map customer journeys and understand the CX at each point of contact. Process mining is a technique that supports discovering, monitoring, and improving processes as they actually are; it is mainly applied in a process management context in organizations. However, it has also been used to study customer journeys [9].

This paper reports on the results of a study that combined the concept of customer journeys and process mining to gain actionable insights for service delivery improvements in the context of Telenor Group, which has 187 million customers across the Nordic countries and Asia. Telenor is currently undergoing an important modernization process, focusing on data, analytics, and customer journeys with the goal of becoming a more data driven and customer centric company. The research question is: How can a service provider utilize process mining on customer journeys to reduce service cost and inbound calls to customer service agents? To answer this, this study used event data from digital channels, such as apps and web solutions, as well as operated channels to map customer journeys using process mining, for two specific customer journeys.

It was found that the designed customer journeys often result in unintended deviations where digital journeys break down and there is need for a customer support. This is also true for simple journeys involving three or four steps. The results presented in

Section 4 suggest that priming the customers to use self-service solutions, had a significant effect on the number of customers that managed the journey fully digitally.

The study discussed in this paper offers several key contributions. First, it integrates the concept of customer journeys with process mining to address a concrete business challenge. Second, it provides a case description where mapping customer journeys by utilizing trace data and process mining tools provides a comprehensive overview of customer behavior, which is needed to evaluate customer preferences, used channels, possible pain points, and to optimize customer journeys to gain actionable insights.

2 Situation faced: SIM-card case

When undergoing digital transformation, CX plays a crucial role [10]. How best to digitize the customer journey has been an important task for service providers as there is increasing demand to reduce operating costs by moving customers from manned to digital channels. To succeed, companies need insight into why customers are calling customer service agents instead of using the self-service solutions. The different touchpoints that customers can use in the setting discussed in this paper, and from which the study's event data were obtained, are presented in Fig. 1.

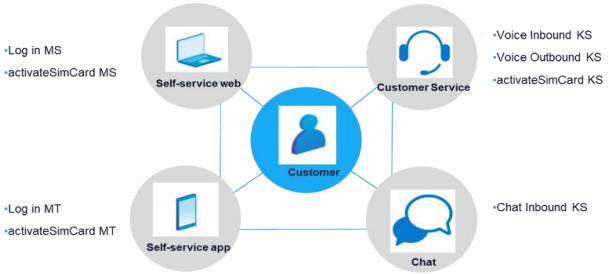

Fig. 1. Mapping different customer touchpoints to channels.

In general, the task of tracking and analyzing multichannel customer interactions across digital and manned channels was difficult, mainly because different platforms give raise to silo data that were difficult to integrate. With an integrated architecture for trace/event data, a company can investigate which channels, touchpoints, and customer journeys are generating the most volume to the call center, and how customers interact across different channels/touchpoints when going through a specific journey.

This study focused on the process of SIM activation because inquiries from the end users related to SIM are one of the top three most frequent reasons to contact customer service. The SIM activation requests represent approximately 10,500 calls per year, which corresponds to 1,300 handling hours and workload for up to two full-time call agents. Ideally, tasks concerning subscriptions and SIM cards should be easily resolved in the digital self-service solutions. So, why were these the most common inquires for customer service personnel? It is important to understand the customers and their journeys across channels and to determine why customers contact customer service instead of using the self-service solution. The study discussed in this paper used the Customer

Journey Framework (CJF) [6, 11] to visualize and analyze customer journeys. This is briefly described in Section 3. Two specific customer journeys for business customers of Telenor were selected and investigated.

The first customer journey (Case 1) was a so-called forced change of an SIM card for users with BankID[1] on a mobile device. The change was initiated by banks to increase the security level of their mobile banking solutions. To continue using BankID on their mobile device, customers with older SIM cards had to obtain newer SIM cards with upgraded technology. Customers in the target group were identified, and the intended customer journey was designed, having a digital self-service focus, as shown in Fig. 2. The color of the touchpoint's circumference reflects the initiator of the touchpoint: the customer (orange) or the service provider (blue) [6].

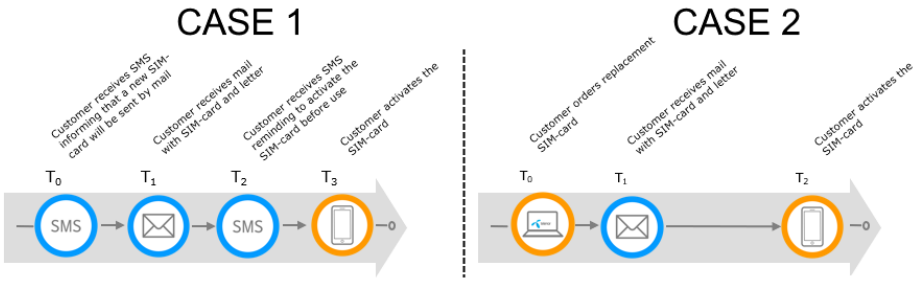

Fig. 2. Two cases: Forced change of an SIM card and ordering a replacement SIM card.

Case 2 analyzed the customer journey for ordering a replacement SIM card. Customers could order a replacement SIM card for several reasons, such as the loss of their device, outdated SIM technology, or errors. Fig. 2 shows that there was no SMS notification during this customer journey.

The two cases are comparable as they have a defined intended customer journey both relating to SIM card replacement. However, the two journeys deviate in two important ways. The first difference is the need to change the SIM card, which is driven by external requirements in Case 1 and by customer needs in Case 2. The second difference is variations in the information provided to the customers along their journey. In Case 1, the customers received an SMS notification to guide them into digital behavior. In Case 2, no SMS notification was given. By studying and comparing these two journeys it is possible to determine whether or not closer follow-up would lead the customer to the desired action.

For both journeys, online and offline data were mapped to identify different touchpoints the customers were going through in these specific journeys. Online data included trace data from end users in the self-service solutions, like the app and web applications. Offline data included data from manned channels.

[1] BankID is a personal and simple electronic ID for secure online identification and signing.

3 Action taken: Process mining and the customer journey

3.1 Qualitative analysis using customer journey mapping

Traditionally, customer journeys have been studied applying a qualitative approach using interviews and case studies and a small sample. In response to Telenor's strategic need to measure CX across touchpoints in 2008, several iterations of customer journey mapping (CJM) in the business units were conducted before the formal launch of the CJF [6, 11]. In this framework, a customer journey is defined as "Customer's interactions with one or more service providers to achieve a specific goal" [6] (p. 846). A touchpoint is defined as an "Instance of communication between a customer and a service provider" [6] (p. 846). The CJF distinguishes between planned or intended customer journeys and actual customer journeys. The intended customer journey reflects the service process as planned by the service provider (Fig. 2). The actual journey is the individual journey that occurs during the execution of a service.

Qualitative CJM studies have previously been conducted at Telenor to establish the "as-is" picture of service delivery as the foundation for service improvements and future redesign. The motivation behind most studies has been to identify the reasons for a high number of customer inquiries or a high churn rate [6, 11]. Although only around 30-40 customers were followed in each of the qualitative CJM studies, the insights led to major changes in the organization [6, 12].

3.2 Analyzing customer journeys with process mining

A drawback of the qualitative approach is the limited number of customer journeys that can be investigated. While valuable insights may be uncovered, the sample taken is often small and could be biased, i.e., only certain customers participate in research studies, and frequent repetition of studies is difficult because they are costly. A data-driven approach is needed. Such an approach should leverage the data recorded by the various information systems supporting the different channels of communication with the customer. Process mining was chosen as the technique to be explored since it has been shown to be successful in mapping customer journeys [9].

The term, customer journeys [6], has been defined as an unfolding process involving a series of events performed by actors to accomplish a desired outcome. The basic data requirements of process mining are event labels and timestamps, and they can be obtained for all the touchpoints for a specific customer. Each sequence of touchpoints for a specific customer for a certain goal (i.e., an actual customer journey) serves as a case and it is possible to extract the corresponding events from Telenor's backend systems into a sequence of events (i.e., a trace). The interaction of a customer with services in a customer journey may potentially be very complex and spread across several systems and organizational entities, leading to highly fragmented data and difficulty in tracking the journey as a single case. To avoid this complexity in the initial exploration of process mining as a method for customer journey analysis, the study discussed in this paper focused on very specific short journeys where integration of the necessary event data was feasible.

Toward that end, the process mining tool, Disco from Fluxicon,[2] was used for the initial process discovery. Disco was chosen because it could be used as a stand-alone tool for this initial exploration, and it could be used in combination with the existing data infrastructure. Disco discovers a process map visualization of the customer journey based on an input dataset where each row represents one event that occurred for a particular customer. The process map visualization indicates the different actual journeys taken by the customers and the frequency of those journeys. Other perspectives are possible, for example, showing the average time between certain touchpoints. The present study focused on frequency since it is less important than the occurrence of certain events, e.g., contacting the customer service agent.

4 Results achieved

Process discovery was applied to both customer journeys. All data were handled in accordance with the requirements of the General Data Protection Regulation and deleted within the defined retentions schedule.

4.1 Case 1: Forced SIM card change

The first customer journey was the forced replacement of the SIM card for BankID users. These customers were targeted in batches. The data from January 2020 that included 7,500 customers were selected. After removing customers that did not have any events, i.e., empty traces, the sample consisted of 4,934 customers.

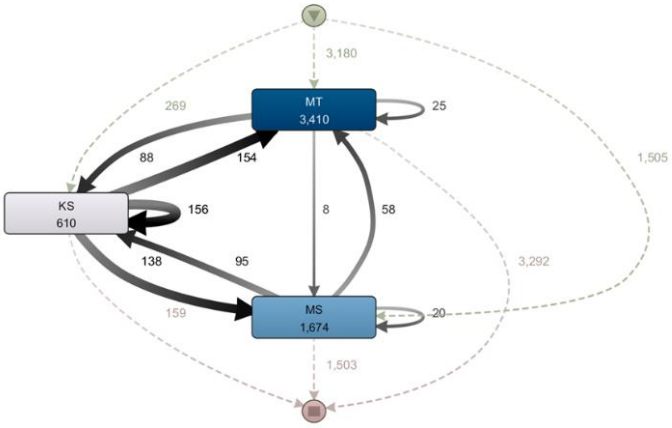

Fig. 3. Process map showing the channels used by end users without any filtering.

Using process mining on a more aggregated level, it is possible to provide an overview of the channels that were used for this journey. The possible channels are mobile app *Mitt Telenor* (MT), web solution *Mine Sider* (MS), and *Customer Service* (KS),

[2] https://fluxicon.com/disco/

including both calls and chat. This analysis used all events and showed all the possible paths in Disco. This approach is possible when looking at the data from a more aggregated level, as shown in Fig. 3, without leading to an unreadable process map. When zooming in (moving from mapping the used channels to relevant trace data for the given channels), we restrict the output to the most frequent paths in order to get a more readable and interpretable model and avoid noise from deviations. The process map depicted in Fig. 3 shows that the preferred channel for SIM activation was the mobile app MT, and most of the customers completed the journey fully digitally (using MT or MS). However, around 10% (453) of the customers needed help from a customer service agent resulting in 610 inquires.

More detail about which channels caused problems and how many customers went from a specific digital channel to customer service, and vice versa, are provided in the SIM card activation process map shown in Fig. 4 (zooming in).

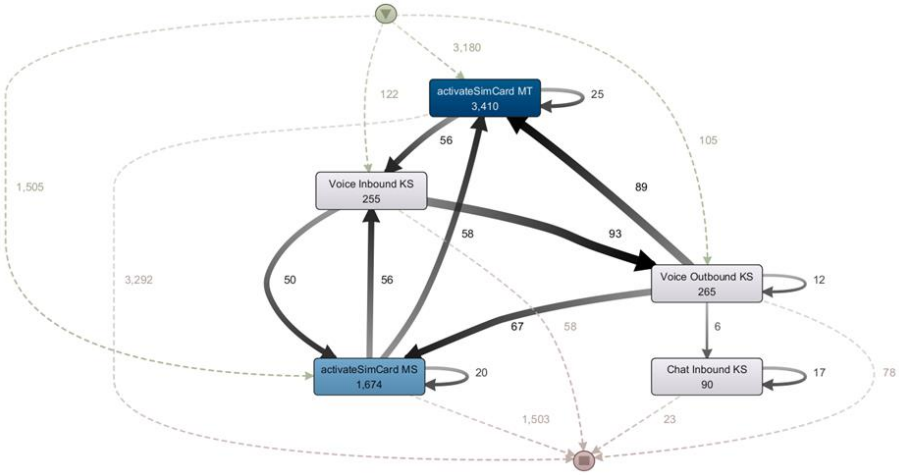

Fig. 4. Process map showing the customer journeys for SIM activation. Level of process map detail: Activities = 100%, Paths = 80%.

While the majority of customers finished their journey fully digitally (90%), some customers encountered issues with the process and needed help. Some of these customers started their journey in digital self-service solutions and ended up contacting customer support, while others started in manned channels and then moved to self-service. It was found that both MS and MT had some pain points and created the need for assistance (i.e., paths from *activateSimCard MT* => *Voice Inbound KS* and *activateSimCard MS* => *Voice Inbound KS*). The process map also shows that 90% of customers that contacted the customer service were redirected to self-service solutions. However, the customer service agents were not consistent in recommending the digital channel for SIM activation. Some customers were redirected to the app solution MT (N = 89), while others to the web solution MS (N = 117). Additionally, 45 of the users made multiple attempts when activating the SIM card (loop to *activateSimCard MT* and *activateSimCard MS*).

Voice Outbound is a callback function where customers can choose to be contacted instead of waiting in a call queue. A total of 105 customers used this function (the direct path from start to *Voice Outbound KS*). For details on what was learned and the initiatives that were undertaken, see Section 4.3.

4.2 Case 2: Replacement SIM card

Case 2 analyzed the customer journey when ordering a replacement SIM card with 1,460 end users in May 2020. Here, the aim was to compare whether the additional step of the SMS notification in Case 1 had any effect on the activation rate in the digital channels. Case 2 did not have this event. Similar to Case 1, the first step is to create a high-level process map outlining the used channels for the end users.

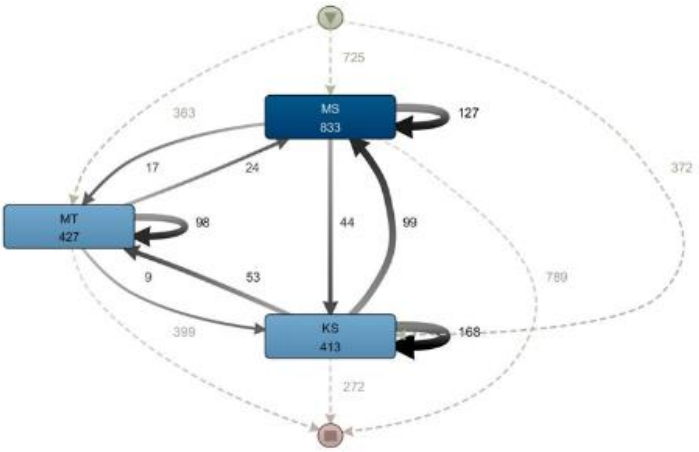

Fig. 5. Process map showing the channels used by end users without any filtering.

The results presented in Fig. 5 show that the web solution MS was the preferred channel for activating a replacement SIM card. This is contrary to the result found in Case 1 where the mobile app MT was preferred. Most of the customers managed the journey fully digitally (75%). However, this percentage is significantly lower than what was found in Case 1; thus, it can be concluded that the SMS notification to customers had a positive effect on increasing the activation rate in digital channels.

A more detailed process map of the customer journeys that involved customer service support is shown in Fig. 6. For this purpose, the events related to the activation process are filtered and the rest are excluded.

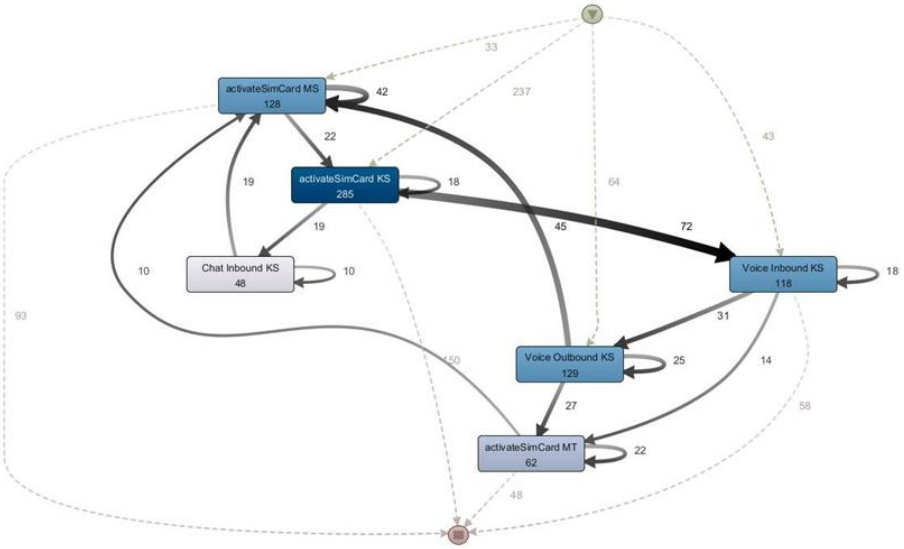

Fig. 6. Process map of the customer journeys that involved customer service. Level of process map detail: Activities = 100%, Paths = 80%.

The results suggest that the web solutions MS was the major channel causing problems with activation of the replacement SIM card; 22 customers needed assistance (activationSimCard MS => activationSimCard KS) and 42 had attempted to activate several times (loop to activateSimCard MS). Of the customers that contacted customer support, 63% decided to outsource the task of activation to the customer service agent (activateSimCard KS); only 27% were redirected to the self-service solutions. These findings were counterintuitive as the customer service agents should encourage and guide customers to self-service solutions. It was also the opposite of what was found in Case 1, where most of the customers that contacted customer support were redirected to self-service solutions.

Being able to categorize and mark digital and non-digital customers creates opportunities for personalization and more advanced customer profile analysis. It also creates the possibility to be more proactive and to design tailored processes for specific customer groups. However, this is out of the scope of this paper.

4.3 Actionable insight

Summarizing the results, the trace/event data from the IT systems were used to map two customer journeys by utilizing Disco. The outlined process maps for both cases indicated that there were deviations from the intended customer journeys. Using process mining helped to isolate these customers, identify which channels were involved, and determine the sequence of activities that generated traffic to customer agents. We also noted that redesigning customer journeys and adding SMS notifications had a significant effect on the number of customers that managed the journey fully digitally. The

insight from process mining provided a more integrated and sequential view of the end-to-end customer journey than existing reporting tools. It also provided the ability to drill down into certain behaviors and customers.

When isolating the customers that started the journey digitally and then contacted customer service, it was found that one issue causing the traffic to KS was related to the dispatched mail containing the SIM card with outdated instructions on how to replace it. This letter and instructions were not consistent with the current versions of the self-service solutions; thus, it caused confusion and inconsistency in the process of activation. Looking at customers that attempted to activate several times in MT or/and in MS, it was found that, in some instances, the self-service solutions were giving error codes that were not intuitive and difficult to interpret, thus generating more traffic to customer support (*Voice Inbound KS* & *Voice Outbound KS*). Additional qualitative analysis of customers starting the journey in manned channels revealed that some customers were unaware that their issue could be solved using the self-service solution. They only needed that reminder or brief guidance to become digital. While other customers called about status of the SIM order or that they had not received the dispatch.

Based on the outlined insights, several initiatives were proposed to address the issue of service delivery improvements. First, there is a need for better routines ensuring alignment between the app developers and the created SIM letters. Second, there is a need for more informative error messages that can improve the activation journey by providing direct feedback with more information. Third, Telenor has started developing an application programming interface for self-service solutions where customers can more effectively follow their SIM orders. There may also be a need for more consistent customer support response guiding how a customer should proceed when having issues with the activation. This process should be standardized to avoid deviations and subjective evaluations of customer service agents.

5 Lessons learned and Discussion

Studying customer journeys through a quantitative approach has been an educational and enriching process for Telenor. It showed the importance of studying and analyzing how customers are behaving by using event data and new tools, such as process mining. Moreover, the quantitative approach for studying customer journeys should not replace the qualitative approach; rather, it should supplement and enhance it. While the sequence of events is similar, there is a conceptual difference between the two cases as they are driven by different customer intentions. It is important to investigate whether the designed customer journeys match the actual journeys of the customers. By doing so, it is possible to identify and eliminate pain points and deliver better customer journeys making them simpler and more intuitive for customers.

To materialize further gains and value from using process mining to map and analyze customer journeys, it is necessary to build and develop an appropriate framework that can be applied to more complex journeys. This requires a common data model that supports event architecture and integrates data, which is easily accessible and contains the important events across different channels. It is also important to integrate the

process mining tool into the Telenor infrastructure to provide real-time monitoring of selected customer journeys.

In the context of Telenor, this includes increasing the level of tagging in self-service applications, selecting the right events, including more customer touchpoints, e.g., channels, campaigns, and enriching the timestamps with seconds, which is useful for sequential tracking. This increases the ability to approximate a 360-degree customer view, enabling a company to become more equipped to create better customer journeys for customers.

In this pilot project with process mining of customer journeys, we experienced some issues with the diversity in how the data are populated. It was revealed that calls routed between the customer service agents were populated over several rows, so they could be presumed to be multiple calls instead of one unique call. Telenor also offers a callback function to its customers, which could be misconceived as repeated calls in the data reported in this study. These aspects might have led to discrepancies in the process maps. Finally, having a 'start-event', including the whole sample size, would have eased visualizations in the process maps, where it would be easier to reveal how many customers dropped out. These issues will be taken into consideration in future work.

6 Conclusion

As customer journeys become finely imbricated, organizational processes are also becoming more complex. Service providers need concepts and tools to understand their customers' behaviors and preferences over time. As this paper has demonstrated, taking customer journeys seriously requires a novel approach. It requires new sources of data that reflect the stream of activities performed by multiple customers. It requires new tools, such as process mining, to identify and map the performed (and not assumed) customer journeys. It requires pattern-aware operationalizations of customer journeys. Only then is it possible to gain actionable insights for service delivery improvements.

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