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A management system to personalize notifications in the TV ecosystem

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Abstract

This article presents a prototype to generate, schedule, and monitor personalized notifications for the TV ecosystem, which encompasses the television, connected devices, and personal mobile devices. Based on the identification of guidelines and usage scenarios in the literature and the collection of empirical data through focus groups, were systematized settings for the notifications according to the type of event/content to be notified. The settings include the sending moments and triggers on the TV set-top box (STB), as well as users' responses to the notifications, like changing the channel, going to an app, or asking to repeat the reminder. The prototype, which will be tested in the laboratory with experts and field tests with users, is part of an R&D project in partnership with a Portuguese IPTV provider, to possibly integrate this feature into their service.

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1. Introduction

Push notifications have become well-established messaging mechanisms on mobile devices to provide personalized information, including alerts about events. In this sense, many notifications are location-based and time-sensitive, which are key factors to their personalized efficacy. In the TV, the use of notifications is still an underexplored field. However, with the proliferation of Smart TVs and streaming platforms, that usually adopt user profiles and use notifications to inform about new releases and foster marathon viewing, this strategy is starting to gain relevance also to generate and measure engagement. As an example of a marketing company approach based on notifications, Braze has developed a proprietary Software Development Kit (SDK) to gather data about the users' activity and how they engage with Smart TVs and over-the-top (OTT) media platforms (e.g. Roku; Apple TV; Android TV, Amazon Fire TV, etc.) [1]. In the case of Amazon Fire TV, it incorporates the Amazon Device Messaging (ADM) which allows to measure the engagement and also admits Android Notifications API for sending local notifications outside the app's UI of Fire TV [2]. In the case of Netflix, it incorporates a Rapid Event Notification System (RENO), which uses a hybrid push-and-pull communication model across various platforms and devices [3].

In the scope of an R&D project in partnership with a Portuguese IPTV provider, that aims to develop a notifications solution to incorporate into the TV ecosystem, a literature review and an empirical data collection through focus groups with potential users were carried out to systematize guidelines to develop a prototype of notification management [4]. Among the most relevant aspects identified in the literature are insights and requirements for the context of SmartTVs [5] and HbbTVs in Smart Home environments based on the Internet of Things (IoT) [6]. Privacy aspects were also highlighted when considering scenarios with multiple users and connected devices [7], as well as the effects of the number of notifications on the locus of attention and cognitive load, often leading to anxiety increase with an impact on task performance [8]. Therefore, careful management of the notifications preferences is essential to prevent the potential negative aspects [9,10]. Additionally, some authors have been focusing on notifications' sending time as one of the key aspects of personalization [11,12]: on the one hand, considering dedicated moments and event-dependent schedules, which may also include priority information alerts, and; on the other hand, considering time fillers that people use to check for updates and recommendations when they are in-between tasks.

One of the main challenges when working with the TV is that it still constitutes a social and shared device, whereas most notifications are personalized and mainly received on personal devices. Thus, one of the greatest potentials of notifications in the TV ecosystem is device connectivity, namely the use of second-screens, which allow exploring companion apps to provide additional information for several purposes, like content discovery [13] or access to marketing actions with benefits for users [14]. Therefore, this article presents the development process of a management system for personalized notifications for the TV ecosystem that will be tested in the field in partnership with a Portuguese IPTV provider. The prototype presented in this article addresses a TV-first approach toward TV STB boxes in the home environment. The document includes four sections: the first contextualizes the project's motivations and objectives; the second describes the adopted methodology; the third presents the proposed solution; and the fourth section systematizes final considerations and future work.

2. Methodology

The methodology comprised a literature review, followed by empirical data collection from two focus groups, that allowed the systematizations of scenarios and notifications parameters [4] that guided the implementation phase of the digital solution, described in this article. The first focus group included a sample of 6 participants between 17 and 44 years old. The second focus group included 6 participants between 64 to 80 years old to corroborate opinions put forward by the first group about the seniors' audience receptivity to the service. Both focus groups allowed the validation and identification of scenarios related to specific content, the most opportune moments for receiving the notification, the preferred formats, and relevant frequency and personalization aspects. From the requirements and scenarios most valued by the focus group participants, we proceeded to the systematization of five thematic categories whose settings have some degree of customization depending on the users' preferences: "Info", "Calendar", "Content", "Services" and "Health". A "Social" category aimed at notifications related to social

interaction between people, namely through telecommunications and social media, was also identified in the focus groups. However, due to its specificity and need for additional technical integration of services, this category was left for a second phase of development and testing. The digital solution presented in this article adopts a TV-first approach to be tested in the laboratory with experts and in field trials by multiple users in the home environment. A second phase of implementation will comprise the personalization dashboard for end-users and sending notifications to personal devices (smartphones and tablets).

3. Development of the prototype

The proposed solution for personalized notifications in the TV ecosystem consists of two main components, respectively on the managers' side and the users' side: a) a management web platform developed within the project and; b) the notifications interface presented on the TV using the IPTV providers' infrastructure. To better understand the proposed solution, Figure 1 and the following subsections contextualize the system's architecture and UIs associated with the tasks managers and users can perform.

3.1. The notifications management platform

The notification manager is a web application that allows managing settings and scheduling the frequency of notifications. The personalization dashboard for end-users will be implemented in a second phase of the project, therefore this article is focused on the digital solution oriented to managers, through which can be added new events to generate notifications and choose parameters and the recipients of those messages. Within the system, the *events* (e.g. a weekly fitness class or a medical appointment) are the content that will generate a variable number of *notifications* (messages displayed on the TV screen), depending if the events are recurrent or sporadic (*periodicity*) and the several schedules selected to send the notifications (*sending moments*). Hence, the sending schedules and the activity registered on the STB respectively constitute *timings* and *triggers* to send the notifications. The user interface of the management system has two macro sections (see Fig. 1): the *Notifications*, which includes the features "Create", "Scheduled" and "Sent" and; the *Recipients*, divided by "Users" and "Houses". In the *Notifications* section is possible to edit the scheduled notifications and monitor the interactions with the sent ones. The "Create Event" page of the notifications manager includes the form for the event characterization fields and the preview of the respective notification messages, generated according to the parameterization of sending moments. The *Recipients* section allows an individual or aggregated management, which corresponds to the various users associated with the STB of a house (identified by the box ID). This distinction is relevant as some notifications are general while others are personal and include the name of the user.

3.2. The UI and user's response to notifications on the TV

Only some notifications request users' feedback (call to action) and the answer options vary depending on the notification category (e.g., switch to a specific program channel in the "Content" category; open apps in the "Services" category; repeat the reminder of medication intake in "Health" category; stop a daily reminder of fluid intake in "Health" category). The notification system adopts two templates from the IPTV partner that allow a customized icon (see Fig. 1). The templates are applied depending on the elements defined during the notifications' *enqueue* process. A notification without a call to action, with at least one button for user feedback, will use a pop-up template presented in the upper right corner of the screen. In this case, the OK key of the TV remote closes the notification. If there is no user interaction, the pop-up has an auto-dismiss of 20 seconds. The notifications that have at least one button (with an URL and caption) will use a template that presents the same format of a pop-up message with a call-to-action caption "Press OK to view options". When pressing OK, the system displays a second message in a horizontal blade with the title (a question), a description, and the answer options defined for the buttons. The answer options can be selected using the directional arrows and the OK key of the TV remote. Although the notification system adopts the interface templates of the partner's branding, a "Customized" category was also included, allowing personalized designs and access to all the sending parameters to be flexible for other scenarios.

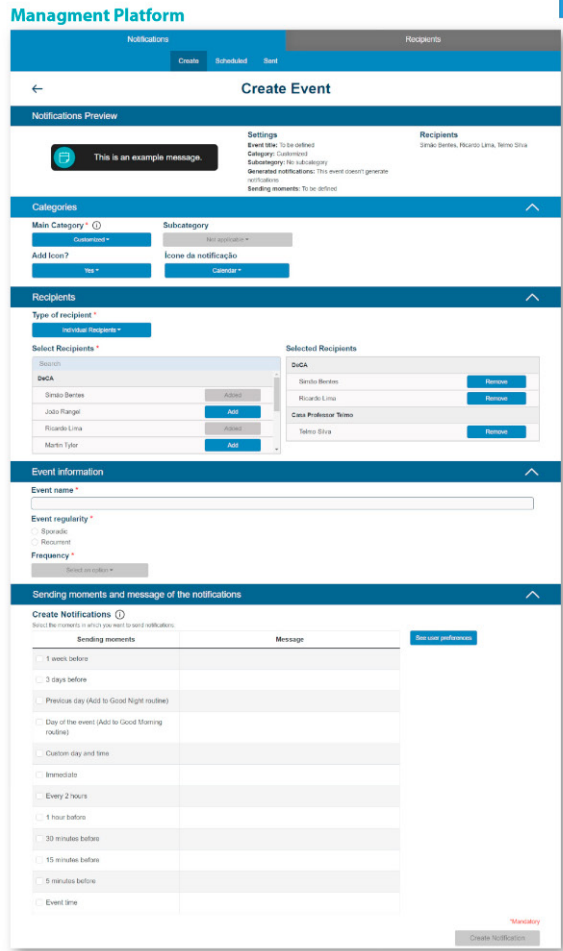
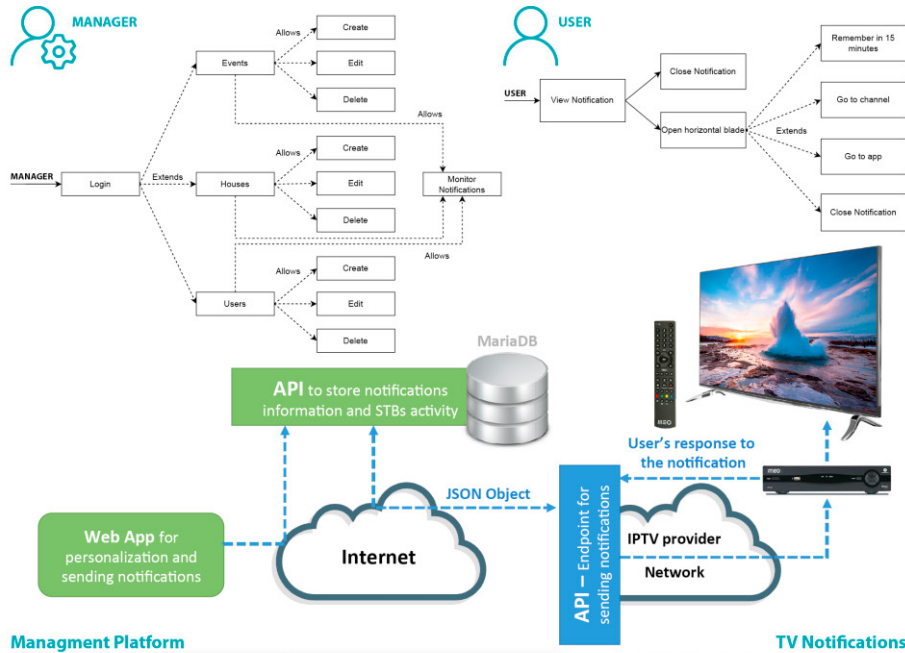


Fig. 1. System architecture of the digital solution to send and manage personalized notifications, including manager’s and user’s tasks and respective UIs of the management platform and the notifications on the TV.

3.3. System architecture and notifications' settings

The notifications management solution is composed by the user interface of the management platform materialized in a web application and the data storage and management. Regarding the notification management web application, the UI was developed using React (<https://reactjs.org>). When any of the interface pages is opened, a request is made to the database to obtain the information necessary to build that page. The information is received in JSON format – from an API also developed within the scope of the project – and is further deconstructed and saved in a variable in the Redux Store (<https://redux.js.org>).

The parameterization of notifications includes the regularity of the event (e.g. a medical appointment or a weekly fitness class), namely the exact day and time and the frequency (daily, weekly and monthly). According to the regularity of the event, the manager can choose certain moments to send notifications, such as a week before, three days before, 30 minutes before, etc. Subsequently, the manager can customize the message for each chosen moment. In the case of a recurring event, after submitting the form, notifications are generated for a defined period of time. In the end, an object with all the notifications is submitted to the database. For the management and sending of notifications, an API was developed in Node.js (<https://nodejs.org/>) using the Express framework (<https://expressjs.com>). All notifications are stored in a relational database – MariaDB (see Fig 1). The insertion of information in the database is performed when a request is received from the user interface component (creation of a new user, new notification, etc.). By querying the database, it is possible to see if there are new notifications that should be sent and to which users.

There are two types of triggers for sending notifications: i) time of sending and ii) user actions (zapping and turning the STB on/off). For the first type (i), a piece of software was developed that, every two minutes, checks the database for new notifications to be sent. The software checks all notifications whose sending time has passed the present time, which have the sending mode as “zapping” (ii), or which are flagged as not sent yet. The second type of trigger (ii), caused by user actions, is launched according to information received from the IPTV provider's platform. Whenever there is a change in the state of the user's STB box – such as: turning the box on/off, changing the channel, or changing the program (no action of the user) – that information is sent to the interface API developed for this digital solution (see Fig 1). In the received JSON object, there is still information about the last interaction performed by the user. To check if the user has zapped, the last record is compared with the current one to see if it has different information. Whenever different information is received, it is registered in the database and the previous one is eliminated. If the user is zapping, the system checks whether there are notifications that have the sending mode set to “zapping” and whose sending time has already passed the present time, but the present day has not passed yet. All notifications associated with zapping need to have a date/time associated, in order to be able to determine when to launch the notification. The notification sending date/time is not allowed to surpass the day it is set to be sent.

In summary, the current prototype has two permanent routines (morning and evening) consisting of sequenced daily notifications (date, weather forecast, and sporadic information) that aim to prepare the following and current day. Besides, the system has presets of sending moments according to the five thematic notifications (see Figure 1). These notifications are associated with categories of actionable events with scheduled timings according to the user's preferences and can also be added to the permanent routines.

4. Conclusion

As contextualized in this article, there is potential for a notification system in the TV ecosystem, to help household daily tasks and appointments while taking advantage of connected devices in a relaxation and entertainment environment of watching television at home, which is substantially different from working environments. In this sense, the partnership with the IPTV provider within this R&D project is paramount for field trials, because it allows access to a robust infrastructure and viewing habits associated with a vast content catalog. Furthermore, the importance of preliminary empirical data collection is also critical because the insights from the literature are not always applicable to other cultural and geographical contexts, namely in terms of digital literacy. Also, the results from the focus groups highlight the discrepancy in users' preferences, which reinforces the

importance of personalization and differentiated management between the personal and the shared dimensions, both embedded in a social device like the TV.

As for future work, the solution will be tested in the laboratory with experts and field tests with end-users. The current version of the prototype allows for creating, scheduling, personalizing, and monitoring the notifications sent to the TV STB shared by several users at home, without considering sending notifications to personal and connected devices. Those devices and the personalization dashboard for end-users (which may also be used by caregivers and tutors, respectively in the case of the elderly and children) will be implemented in a second phase of the project. The first stage of evaluation will be focused on getting feedback about the presets of presentation and parameterization of event-based notifications. In the second stage of evaluation, those settings may be directly customizable also by the end-users. Hence, the innovative contribution of this solution is the social focus and the proximity mediation, more than being an automated and massive delivery mechanism using the TV ecosystem. This solution aims to provide notifications managers (that can also be end-users, family members, and caregivers) a tool to facilitate their daily lives and foster social dynamics, both at home and attending outdoor events.

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