

## Towards a Smart Assistant for Enterprise Availability Management

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**Abstract:** In today's work environment, people are increasingly available because of the vast distribution of smartphones. This leads to a lack of real leisure time without being disturbed by phone calls or e-Mail concerning job issues. In the last few years, several large companies in Germany addressed this issue using more or less successful methods like switching off mail servers after working hours or deleting mails received during holidays [Fa14], [We14]. Tough, these methods seems to be either too strict or do not provide an accurate solution for the different needs of the different roles in a company. In project SANDRA, we aim at the development of a smart assistant in order to provide non-disturbed leisure time for employees. The assistant will both delay the delivery of mails based on the content (e.g. natural language processing, deep learning) and on additional information such as roles, holiday, or location. In addition, phone calls can be rejected by the assistant. The project also has a focus on privacy aspects and several legal aspects such as labour management regulations and data protection laws. The development will include enterprises for gathering of requirements, continuous testing and optimisation as well as for the evaluation. For the evaluation of the system, stress levels will be measured based on the heart frequencies of the test users with and without using the system over a longer period of time.

**Keywords:** Availability, Assistance Systems, Privacy, Data Protection

### 1 Introduction

The vast distribution of modern communication technology, such as mobile internet and mobile IT devices, has significantly changed the way we work and has changed our working environment as well [Sa13], [TRR07]. For many employees, information technology makes it possible to work close to everywhere at any time. This can increase productivity but also results in a blurred separation between work and private life [DBJ14], [FS12]. Technologies such as smartphones nowadays are widely distributed and increase the technological availability of employees even more. Research shows that these factors can lead to technological stress and can cause health issues [AGP11].

Recent surveys among employees in Germany show that 67% are reachable by phone and email during their holidays [Bi16], 30% feel that mail and smartphones increase their stress level [Yo16]. Another interesting fact is that 46% assume increasing surveillance of their work due to the increasing use of information technology [DG16].

Several labour representatives and politicians are worried about the situation. In the last

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years, also large companies in Germany addressed this with different organisational or technological approaches. While BMW agreed to a bargaining agreement that included the right of being unavailable after working hours [We14], Daimler offers employees to automatically delete e-Mail while on Holidays [Fa14]. Volkswagen's approach is to block all incoming e-Mail after working hours, on holidays or at weekends [We14].

In this paper we describe ongoing work in the research project SANDRA. We focus on the architecture of the smart availability assistant. Due to the fact that the project is in an early stage, future changes to architecture may be required e.g. for data protection, security or legal reasons.

## **2 State of the Art**

First research results in the area of availability management go back to the early 90ies, when mobile telephony and the world wide web started to become increasingly important [SS93]. In 1999, Roßnagel and Haux [RH99] developed and evaluated concepts which are partially realized in today's smartphone software, e.g. role concepts and different profiles like "mute" or "away". This early research though did not implement solutions for an enterprise-wide availability management in regard to nowadays smartphone technology.

Since 2014, the project Always Online / Social Link [UK17] does research in the area of permanent technological availability in order to improve work-life balance of knowledge workers. Unlike SANDRA, this project relates to a general communication paradigm and does not focus on creating solutions for enterprise availability management.

## **3 General Approach**

In order to realize a smart availability assistant for enterprises, our approach is to create non-disturbed leisure time without being disturbed by work-related phone calls or e-mail. The assistant will delay the delivery of mails based on the content (e.g. natural language processing, deep learning) and on additional information such as roles, holiday, or location. In addition, phone calls can be rejected by the assistant.

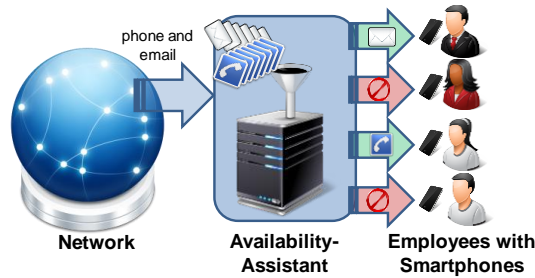


Fig. 1: General Overview of System Functionality

## 4 System Architecture

This section describes the architecture of the availability assistant and the underlying architectural goals.

### 4.1 Architectural Goals

The system architecture follows these main architectural goals:

- **Scalability:** services can e.g. be duplicated if more computing power is required.
- **Extensibility:** Additional services can be included and used by defining corresponding rules in the layer above.
- **Modularity:** services can be excluded / included as required. E.g. controversial services like positioning of employees can be removed if a workers' council does not accept this feature.
- **Decomposability:** Developers involved in the project can develop, manage and maintain their own artefact(s) in a decentralized way. Additionally, different programming languages and different environments can be used (e.g. Java for classic server side programming while Python is frequently used in natural language programming or in the area of artificial intelligence).
- **Separation of concerns and abstraction:** The architecture has to follow a modular approach [EWD76] to allow the distribution of efforts among the development team and achieve an easier collaboration by the reduction of technical dependencies. A related approach followed by the architecture is the reduction of complexity by abstraction [Sh95]. Hiding details of the specific implementation of specific system components allows easier maintenance as well as easier usage by other components.

## 4.2 Architecture Overview

The overall system is divided into a server-side component and a client-side component which is running on the user's smartphone. The main functionality is provided by the server-side Mail Analysis Module and the Phone Call Analysis Module which is running on the client.

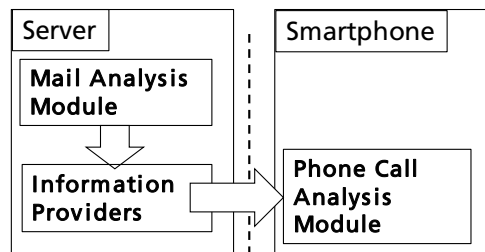


Fig. 2: General Architecture Overview

## 4.3 Mail Analysis Module

The Mail Analysis Module is responsible for the decision whether an e-Mail is to be delivered immediately to the user or delayed for a certain amount of time. The module is internally structured by a layered design:

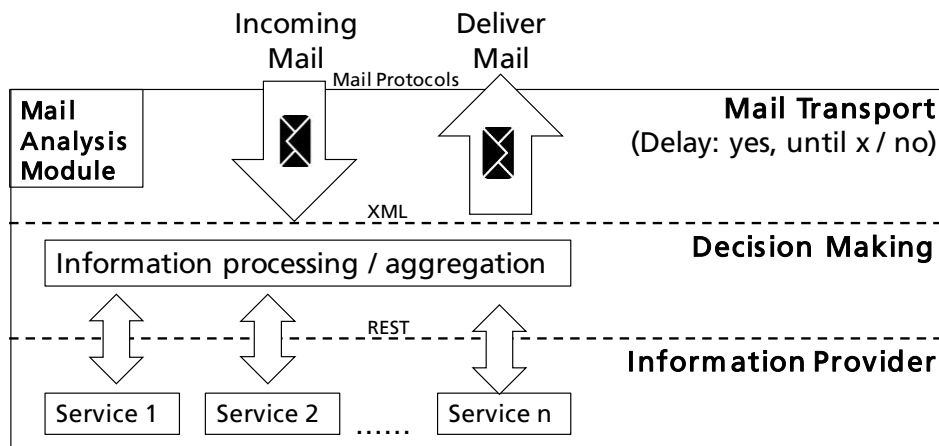


Fig. 3: System Architecture – Mail Analysis Module

**Mail Transport Layer:** This layer is responsible for handling incoming mail, converting it to xml, passing it over for analysis and finally delivering it to the user.

**Decision Making Layer:** This layer provides configurability for the system behaviour. Using the provided rule definition language, stakeholders can define which mails should be delayed based on the information provided by the layer below.

**Information Provider Layer:** The information provider layer is realized as an extensible set of services. This architectural approach is similar to a micro services architecture [NS14].

#### 4.4 Phone Analysis Module

The Phone Call Analysis Module has the same architecture than the the Mail Analysis Module as shown in figure 3. The main difference is that only a subset of the information providers is used because the only piece of information that exists for an incoming call is the caller's identity linked to the phone number. There is no further content available that could be analysed.

## 5 Conclusion

In this paper we described our approach towards an enterprise wide availability management using a smart assistant that analyses incoming mail and phone calls in order to delay or block communication in leisure time in a smart way. We described the planned architecture of this system and focussed on a high level view of the technical determinations of the structure of the system.

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## References

- [NS14] Namiot, D.; Sneps-Sneppe, M.: On micro-services architecture. In *International Journal of Open Information Technologies*, 2014, 2. Yr., No. 9, pp. 24-27
- [EWD76] Edsger, W.; Dijkstra, E. et al.: *A discipline of programming*. Prentice Hall, 1976, ISBN 978-0-13-215871-8, p. 56.
- [Sh95] Shaw, M.; DeLine, D.; Klein, V.; Ross, T.; Young, D.; Zelesnik, G.: Abstractions for software architecture and tools to support them. In: *IEEE Transactions on Software Engineering*. Vol. 21, No. 4, ISSN 0098-5589, pp. 314–335, 1995

- [We14] Welt.de, Warum Arbeitgeber plötzlich die E-Mail ausbremsen <https://www.welt.de/wirtschaft/karriere/article124960587/Warum-Arbeitgeber-ploetzlich-die-E-Mail-ausbremsen.html>, 2014, last visited: 20.7.2017
- [Fa14] FAZ.net, Daimler-Mitarbeiter können Mails automatisch löschen lassen, <http://www.faz.net/aktuell/wirtschaft/unternehmen/daimler-mitarbeiter-koennen-mails-automatisch-loeschen-lassen-13096014.html>, 2014, last visited: 20.7.2017
- [Sa13] Sayah, S.: Managing work–life boundaries with information and communication technologies - The case of independent contractors. *New Technology, Work and Employment*, 28(3): pp. 179-196, 2013
- [TRR07] Tarafdar, M.; Tu, Q.; Ragu-Nathan, B. S.; Ragu-Nathan, T. S.: The impact of technostress on role stress and productivity. *Journal of Management Information Systems*, 24(1): 301-328, 2007
- [DBJ14] David, K.; Bieling, G.; Jandt, S.; Ohly, S.; Roßnagel, A.; Schmitt, A.; Steinmetz, R.; Stock-Homburg, R.; Wacker, A.: Balancing the Online Life: Mobile Usage Scenarios and Strategies for a New Communication Paradigm. *IEEE Vehicular Technology Magazine*, September, 72-79, 2014
- [FS12] Fonner, K. L.; Stache, L. C.: All in a day's work, at home: Teleworkers' management of micro role transitions and the work–home boundary. *New Technology, Work and Employment*, 27(3): pp. 242-257., 2012
- [AGP11] Ayyagari, R.; Grover, V.; Purvis, R.: Technostress: Technological antecedents and implications. *MIS Quarterly*, 35(4): pp. 831-858, 2011
- [Bi16] Bitkom.org: Mehrheit der Berufstätigen ist auch im Urlaub erreichbar, <https://www.bitkom.org/Presse/Presseinformation/Mehrheit-der-Berufstaetigen-ist-auch-im-Urlaub-erreichbar.html>, 2016, last visited: 20.7.2017
- [Yo16] YouGov.de: Viele Berufstätige sind ständig erreichbar, <https://yougov.de/news/2016/01/25/viele-berufstatige-sind-standig-erreichbar>, 2016, last visited: 20.7.2017
- [DG16] DGB-Index Gute Arbeit Themenschwerpunkt Die Digitalisierung der Arbeitswelt, <http://index-gute-arbeit.dgb.de/++co++76276168-a0fb-11e6-8bb8-525400e5a74a>, 2016, last visited: 20.7.2017
- [RH99] Roßnagel, A.; Haux, R.: Mobile und sichere Kommunikation im Gesundheitswesen. Braunschweig: Vieweg (DuD-Fachbeiträge), 1993
- [SS93] Schneider, M. J.; Sarbinowski, H.: Mobil und jederzeit erreichbar. In: *GMD-Spiegel* 4, S. 93., 1993
- [UK17] Universität Kassel: "Always Online?" - ein neues Kommunikationsparadigma für die Kommunikationsgesellschaft (Social Link), <http://www.social-link.uni-kassel.de/home>, last visited: 20.7.2017