Developing for Android

Development of an alarm system for the Samsung Galaxy S4 Mini and the Samsung Gear S for Adobe SiteCatalyst

Seminar Thesis

Course of study: Information Systems

Vienna University of Economics and Business

by

Tanja Simon

Submission date:	March 6, 2015
Matriculation number, course:	h0851540, 0208 Project Seminar of Information Systems
Supervisor:	ao.Univ.Prof. Dr. Rony G. FLATSCHER

Declaration

I do solemnly declare that I have written the presented research thesis

> *Developing for Android - Development of an alarm system for the Samsung Galaxy S4 Mini and the Samsung Gear S for Adobe SiteCatalyst*

by myself without undue help from a second person others and without using such tools other than that specified. Where I have used thoughts from external sources, directly or indirectly, published or unpublished, this is always clearly attributed. Furthermore, I certify that this research thesis or any part of it has not been previously submitted for a degree or any other qualification at the Vienna University of Economics and Business or any other institution in Austria or abroad.

Vienna, the March 6, 2015

Tanja Simon

Abstract

This paper investigates the creation of a monitoring application for a Samsung Gear S wristwatch and a Samsung Galaxy S4 Mini mobile device. The emphasis is to show how both devices can be used together to inform the user about errors in Adobe Analytics to be able to intervene in a timely manner when dealing with critical values. Therefore, the external reporting application programming interface is used to get direct access to the stored Adobe Analytics data. With a REST client, the data is analysed on the Samsung Galaxy mobile phone and is then sent to the Samsung Gear S to inform the user.

Contents

List of Abbreviations

API	Application Programming Interface
CSS	Cascading Style Sheets
HTML	Hypertext Markup Language
IDE	Integrated Development Environment
JSON	JavaScript Object Notation
OS	Operating System
REST	Representational State Transfer
SDB	Smart Development Device
SDK	Software Development Kit
SOAP	Simple Object Access Protocol
TV	Television
URL	Uniform Ressource Locator
USB	Universal Serial Bus
WSDL	Web Service Description Language
WU	Vienna University of Economics and Business
XML	Extensible Markup Language

List of Figures

1. Introduction

Adobe Analytics is an online tool that combines various digital marketing solutions and supports the marketer in understanding user interaction with a website or an application. Marketing defines a process until a product or service is received by the consumer. The different ways to inform or convince the user are summarized by the term "channel" which groups similar advertising methods and processes. Examples are TV or radio advertisements. The main goal of Marketing is to satisfy the needs of the customer. According to an article from Douglas Idugboe, Digital Marketing is an important tool for businesses, because it combines electronic technology with psychology in the marketplace. With its help it is possible to interact with the customer on a new digital channel in addition to traditional channels like print. The main advantage from digital marketing is the real time feedback from the user that is used to interact and communicate quicker and it helps to create a better experience for the user (Idugboe 2014). It becomes more important to differentiate the product from those of the competitors by combining the traditional and the digital marketing channels. Kates discusses in his article how to achieve a working combination of these two parts. Digital experience can be created by using traditional marketing that enables the marketer to reach a larger clientele to establish a deep relationship with the user via digital marketing. One of the examples shown in the article is a TV advertisement broadcast during the Super Bowl that is used to motivate the watcher to like their Facebook page. This deeper interaction with the user is known as active engagement and it leads to a greater outcome of an advertisement with the help of a digital channel. Personalized Experience describes the way of how information is tailored based on specific characteristics. In the area of marketing, content is changed based on the user information entered into a registration form. Or the user gets a specific landing page on the website based on his interests or search results. Additional information from social media websites, like Facebook, makes it easier for marketers to target users based on their given data. Therefore, digital marketing is an important tool to - in combination with traditional channels - generate a reasonable way to gain bigger results in marketing (Kates 2013). The collected behavior data can be collected and analysed by a Web Analytics Software. It is a browser based program to create statistics to get deeper insights of the usage of websites. Kausik describes in a book that Web Analytics is the "objective tracking, collection, measurement, reporting, and analysis of quantitative Internet data to optimize websites and web marketing initiatives" (Kaushik 2007).

1.1. User Behaviour Analysis with Adobe Analytics

To better understand the behavior of the user on the websites, web-based software like Adobe Analytics is available for larger companies. A cheaper option for smaller firms, sole traders or private individuals is Google Analytics. The standard version is for free, but if the hits increase to 1 billion hits per month, a premium account with a tailored fee must be paid. The disadvantage about Google Analytics is the fact that a user consents to the usage of the collected data by Google by accepting the Google Analytics terms of service.

"Google and its wholly owned subsidiaries may retain and use, subject to the terms of its privacy policy (located at www.google.com/privacy.html), information collected in Your use of the Service." (Google 2014)

Although special consent of the customer is needed so that Google is allowed to share the information with other companies, the data is used and analysed by Google itself. This enables Google to collect more and more data about the people and its habits and therefore to eliminate the customers' privacy. This work uses Adobe Analytics, which according to a review by G2 Crowd, is a leader in the area of Web Analytics software in 2015. A tool is placed in this category if the users of G2 Crowd have rated the product highly enough. A thusly nominated leader also has a substantial scale, market share and global support and service resources. Adobe Analytics provides a well-established external access to the stored data with a high authentication standard (Crowd 2015).

Adobe Systems was founded in 1982 by John Warnock and Chuck Geschke and started with two employees. It focused on the creation and interaction with Digital Media. Omniture was founded in 1996 by Josh James and John Pestana, has an emphasis on Web Analytics and was taken over by Adobe Systems in 2009. This allowed Adobe to expand Digital Media by Digital Marketing. Such extension adds additional features like experience management, social capabilities and content combination. In 2012 the Adobe Marketing Cloud has started to arrange the various topics and to provide a platform for hosting data. Summarily, it is a collection of various tools which include Adobe Analytics and other areas.

Figure 1.1.: Parts of Adobe Marketing Cloud (Systems 2015*a*).

Figure 1.1 shows a list of the provided tools of the Adobe Marketing Cloud. The advantages are that the marketer can easily combine data between the tools. For example, email campaigns are connected with Facebook campaigns to allow for better coordination. A campaign is a set of advertisement messages that relate to an issue and are communicated to the customer. Adobe Analytics is used for the analysis of user behaviour on the pages of the website. It helps in identifying high-performance channels and gives a general review of the homepage. This package includes SiteCatalyst that is the main tool to show and analyse reports. Every other Adobe Marketing product can be connected with SiteCatalyst. Another tool is Adobe Campaign. It supports traditional channels like email with an automation and execution process. Messages or weekly newsletters are sent to the customers without any manual interaction . Adobe Experience Manager simplifies the creation of a uniform user experience across different media like mobile and desktop. Therefore, a user is presented with a consistent layout whether they see the website on the mobile phone or the computer. Adobe's Media Optimizer concentrates on the construction of the media mix. It supports the marketer in dealing with various videos, advertisements on Facebook, search keywords and feeds. With Adobe Social it is possible to control the publishing process of social media. If enough data is collected, the tool is able to create a prediction if a campaign will be successful or not. The last tool in the Adobe Marketing Cloud is Adobe Target, which can change personal settings in real-time. It also includes A/B testing that is used to compare elements with each other. For example, a marketer would like to know if the customers prefer a green background or a red one. Through an A/B test, a group is split up into two parts based on predefined percentages. Each user group gets a different background colour. Via the reaction of the users one can then draw conclusions about which colour they are more satisfied with (Systems 2015a). The analysis of the behaviour of the users as-

sumes a huge collection of data. This is achieved by embedding a specific Analytics JavaScript code into the website for each page that sends the data to the Data Center from Adobe.

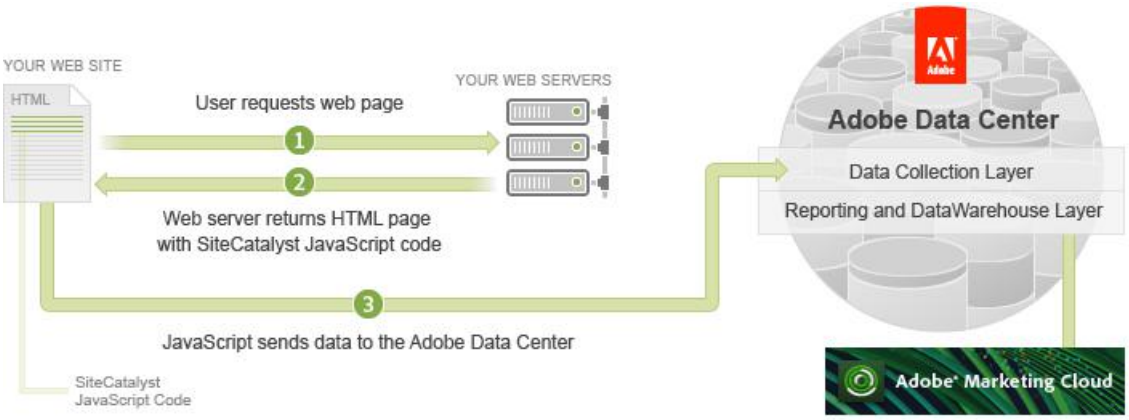


Figure 1.2.: Process of data collection from a website to the Adobe servers (Systems 2015*a*).

The figure 1.2 shows how the data collection process works. First, the user opens a page from the website that contains the Analytics JavaScript code. In the background, a request is sent to the servers where the website is located, whereupon they will return the corresponding page with the HTML and Analytics JavaScript code. Then an image request - a 1x1 pixel image that is not visible -transmits data from that page to the servers from Adobe. This request contains a query string that is a part of the URL (uniform resource locator) which contains parameters that are analysed by the system. So the Adobe JavaScript code collects the needed information from the page and sends the data to the Adobe servers inside the query string. A parameter is characterised as follows: `field1=value1&field2=value2` (Wikipedia 2015*c*). The field is the name of the parameter and the value contains the information that should be saved in it. The capacity and size of the sent data in an image request depends on the rules that are inside the Adobe code. For example the page name and the timestamp of the request are commonly included. In the sent query string the page name is called 'pagename', the variable is 's.pageName' and it contains the name of page that the user visits. This process goes through every time a page with an activated Adobe JavaScript code is called (Systems 2012).

The existing data in the Adobe Data Center can be analysed in the graphical

user interface Adobe Analytics. Therefore, data must be categorized in report suites e.g. to enable a separate reporting for a website. It is also possible to combine various websites in one suite if they belong together. This is done to be able to view data only for one specific website or group. It is also possible to compare report suites among each other. In Adobe Analytics the data is displayed in the form of reports.

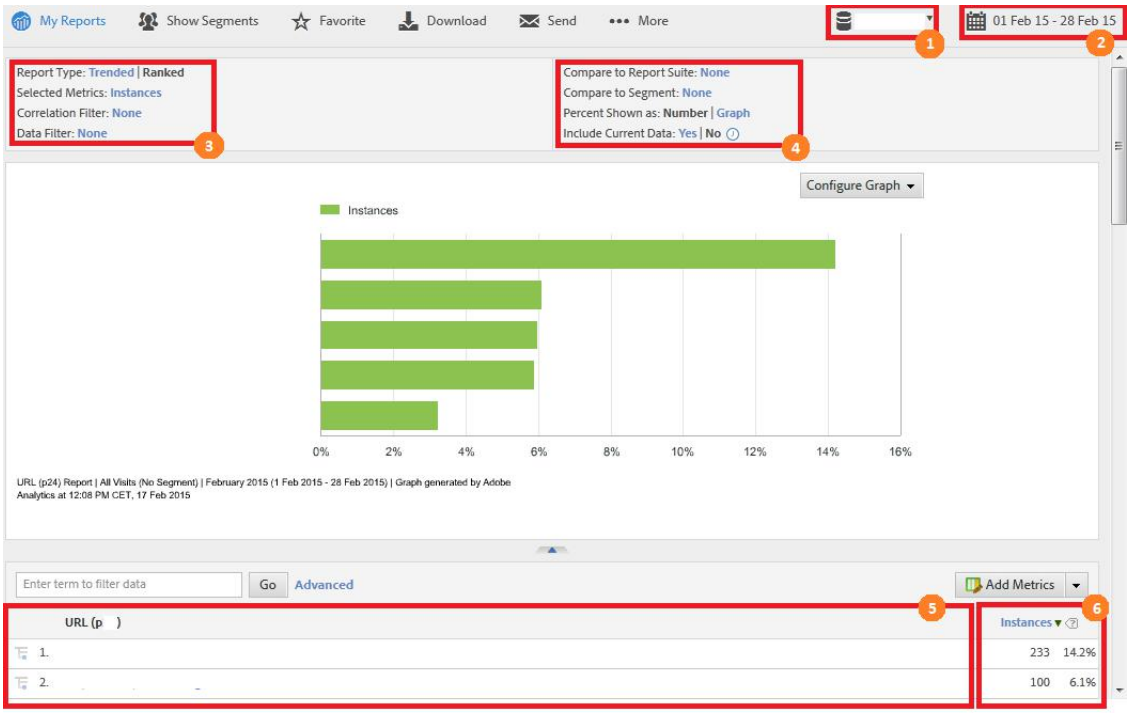


Figure 1.3.: Sample report from Adobe Analytics that shows the number of called URLs for February (Systems 2015*b*).

The image 1.3 shows an example report from Adobe Analytics. Under number one, the user can choose between different report suites. If the suites are set to specific websites, then the dropdown field will show their names. To its right, the time period for the report can be adjusted. Below, the number three and four mark the configurations of the representation of the report. The report type defines whether the data should be displayed per date (trended) or aggregated for the whole time period (ranked). "Metrics are quantitative information about visitor activity, such as Views, Click-Troughs, Reloads, Average Time spent, Units, Orders, and Revenue." (Systems 2015b). The given report shows instances as a metric. It

is used to display how often a variable is set. On account of the fact that the report shows URLs, the given metric sums up how often an URL was invoked for the given time period. The values are displayed as column in the report and are marked with the number six. The next important setting in the header is the data filter. By using it a user can quickly find a specific entered term. It has some advanced features to exclude or include search words as well. In the red rectangle of number four the first setting is to choose another report suite. The report below will then show the figures next to each other, enabling the marketer to easily compare figures. A segment is a filter that creates a subset of the shown data of the report at hand. For example a user would like to see only the URLs from a user who speaks English. To achieve this output, a filter for the language English must be implemented in the segment. Afterwards, the segment can be selected in the URLs report. The other settings of the report enables the marketer to choose whether the percentages shown should be displayed as a graphic or not and if realtime or current data is needed. The URLs, upon which the instances are grouped, are shown in the field number 5. Each link appears only once and the Instances are summed up per entry.

Various circumstances lead to a wrong data collection. This can be caused by errors in the code integration process from an internal or external frontend development team, a wrong campaign or redirected traffic from the marketing and the implementation of new technologies like Tag Management tools, which help to integrate JavaScript code to read information from the website without writing a single line of code. Therefore, it is advisable to monitor the amount of incoming traffic and events on the website.

1.2. Adobe Anomaly Detection Reports

As there is always the possibility that errors occur in the data collection process, it is important that a system is monitored. At the time of this work's creation, Adobe provides standard reports to monitor a trend over a longer time period, realtime reports to check the current incoming traffic, and Anomaly Detection reports. The latter report additionally has the ability to use statistical methods to check if the given value has changed or not based on previous data.

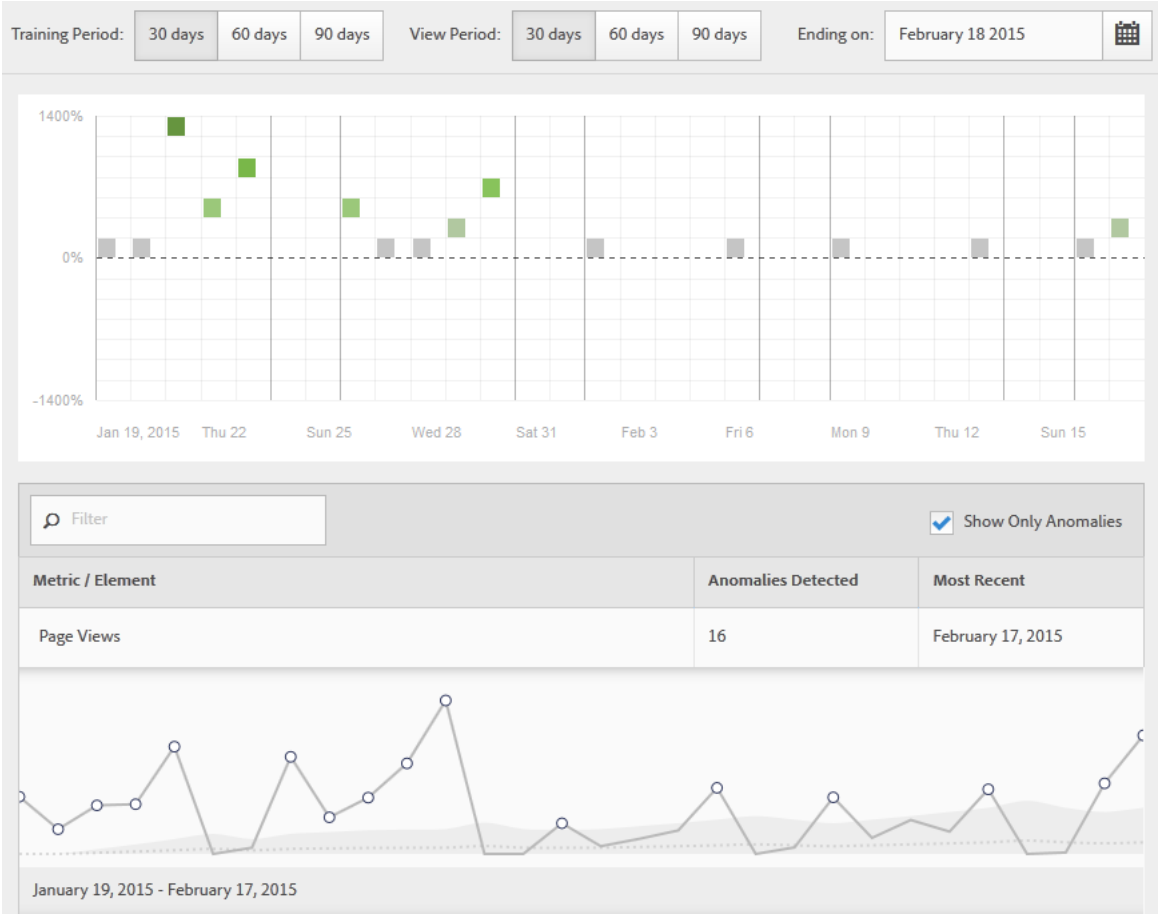


Figure 1.4.: An Anomaly Detection Report from Adobe Analytics that shows if a time series contains values that are out of the norm (Systems 2015*b*).

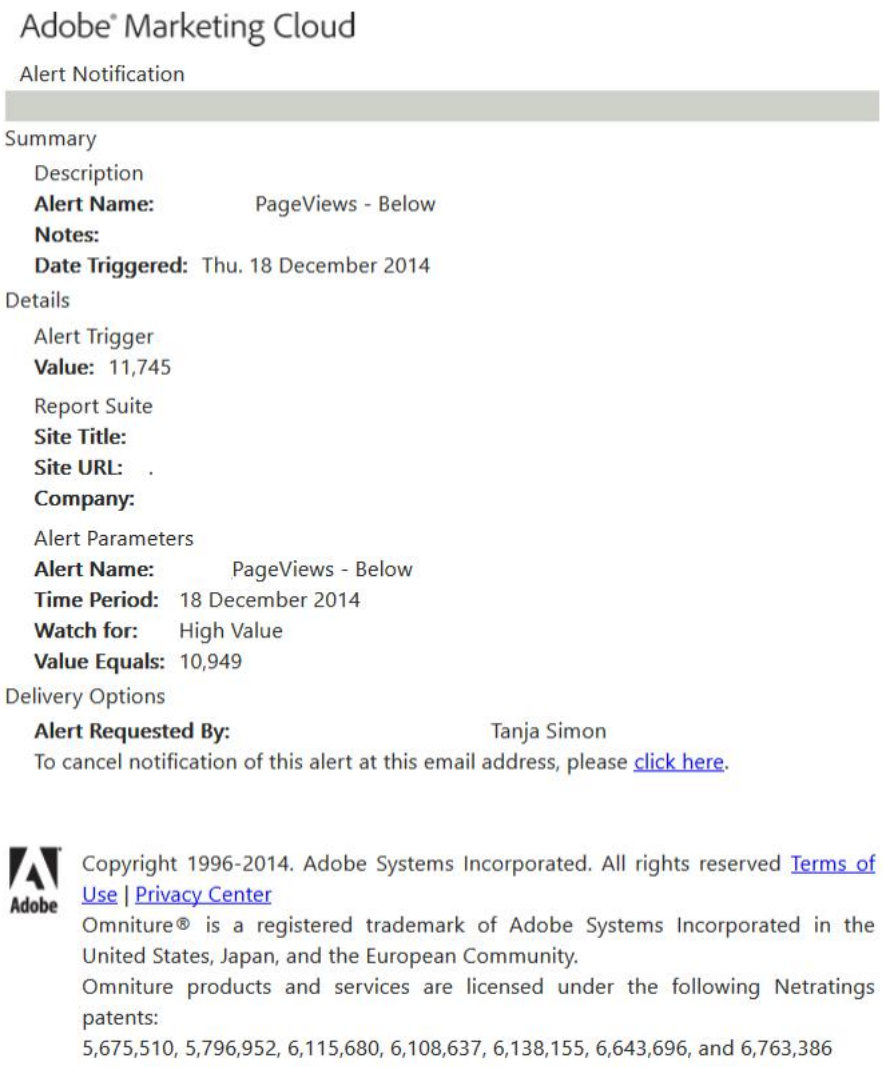
Figure 1.4 shows an example Anomaly Detection report for the number of called pages of a specific website or report suite. With this report it is possible to check whether a fluctuation is critical and must be checked or not. The figures are based on results from a training period that can be 30, 60 or 90 days of length, depending on the selection of the user. The same options are available for the reporting period. In this example, both periods are set to 30 days. Therefore the report learns from the last 30 days and predicts the data for the next 30 days reporting period. For example, the viewed period is from 19*th* January 2015 to 17*th* February 2015. So the report's training period is 30 days before from 20*th* December 2014 to 18*th* January 2015. Each day of the reporting period is calculated by checking the sum of the page

views per day with the training period by using these algorithms: Holt Winters Multiplicative (Triple Exponential Smoothing), Additive (Triple Exponential Smoothing) and Holt's Trend Corrected or Double Exponential Smoothing (Systems 2015c).

Prajakta S. Kalekar explains Holt-Winters Exponential Smoothing as a solution for seasonal forecasting problems and to help analysts to understand the trends and seasonality changes of values. The various models are verified or validated by historical data and calculated error measures like MAPE (mean absolute percentage error). For Adobe's Anomaly Detection reports the additive, multiplicative and trend corrected algorithms are used to determine the smallest SSE (sum of squared errors). Afterwards, the MAPE and current Standard Error are applied to control the validation. For example, the page views for a specific website increase by one thousand euros in January every year. So this value can be added to the forecasts for each January to the annual average and is described as additive method. On the other side, the page views of a specific registration page on this website increase by 20% or a factor of 1.2 every January. This means that even if there is an annual overall increase of page views over the years, only the absolute values change but the percentages remain constant. Therefore the factor 1.2 is a multiplicative character. Summarily, it can be said that the additive method demonstrates a steady seasonal variation and is independent of the overall level. Whereas with the multiplicative method the variability depends on the overall level (Kalekar 2004). The third algorithm of the Anomaly Detection is Holt's Trend Corrected that is used, if the growth rate varies over time.

Time series analysis uses smoothing to better recognize trends. Exponential smoothing weights recent values higher than older values. For example, if a year has 100% then the 4-month moving average is 25% each month. By contrast, the exponential smoothing adds a higher weight to recent values because it has a higher impact on the values. As mentioned before, two types of trends are important for Adobe Analytics: a long-term (Double Exponential Smoothing) and a seasonal (Triple Exponential Smoothing). For the Anomaly Detection, all algorithms are calculated to get a forecast and the one with the minimum error is chosen. At the end three main values are returned: upperbound, lowerbound and forecast. Upperbound is the top limit and if the figure is above it, it is an anomaly. The lowerbound is the lower limit and if the figure is beneath it, it is an anomaly. The forecast is right in the middle between the upper and lower limit and prognoses the data based on the calculations. The sample report shows that most outliers are above the upper bound. They are marked as a circle or square and they change the the colour to green the farther away they are from the normal area. The disadvantage is that this report must be called manually for the values to be analysed. For a company that has more than one website with a lot of different metrics, this is a

time consuming task. An application that automatically checks the anomalies for the previous day would help to reduce the working hours of the employees and to discover errors more effectively. If an anomaly is detected, a message will be sent to the Samsung Gear to inform the user about it. Adobe Analytics has a function called 'Alerts' that has the ability to send automatic emails if a metric has a certain value. For example, if the page views of a website are below 11,745, then an email will be sent to 'maxmusterman@muster.at'.



Adobe® Marketing Cloud

Alert Notification

Summary

Description

Alert Name: PageViews - Below

Notes:

Date Triggered: Thu. 18 December 2014

Details

Alert Trigger

Value: 11,745

Report Suite

Site Title:

Site URL: .

Company:

Alert Parameters

Alert Name: PageViews - Below

Time Period: 18 December 2014

Watch for: High Value

Value Equals: 10,949

Delivery Options

Alert Requested By: Tanja Simon

To cancel notification of this alert at this email address, please click here.

Figure 1.5.: Sample alert report that is sent as an email to the responsible person, the number of page calls are below 11,745 (Systems 2015*a*).

The picture 1.5 shows an automatic alert notification from Adobe Analytics in form of an email. On December 18*th* of 2014 the overall page views of a specific website were below 11,745. The disadvantage is that the notification is only sent by email. This requires access to a client email program like Microsoft Office Outlook. Moreover, the message includes only figures or text and no diagram or charts to visualize it. In this example, an additional chart that shows the page views of the last week in combination with the forecast, upper and lower bounds would provide a better understanding, if there is an error or not. Thus, there is a need for an application that automatically sends a notification if an anomaly is detected. The wearables from Samsung like the Samsung Gear S wristwatch can assist this process by presenting and providing the necessary information in a compact form.

2. Creating a Gear Application

This chapter explores the different types of interaction between an application of an Android mobile phone and a wristwatch from Samsung. The creation of an application that communicates with both devices implies that some sort of connection must exist between them. In the scope of this thesis, the different operating systems of the Samsung mobile phone and the Samsung wristwatch will be be examined as well.

2.1. Development Equipment from Samsung

The notification application uses the following two devices: Samsung Gear S and the Samsung Galaxy S4 Mini mobile phone. The Samsung Gear S that is shown in picture 2.2 is a wristwatch that has an arched surface and it provides the basic functionalities of a mobile device. like the ability to receive messages and to answer calls. To be identified in a network and to get access to the Internet, a SIM (subscriber identity module) is used by the mobile provider. It is possible to add this card to the watch to use its features without a consistent connection to a mobile phone. Without the card, the Samsung Gear S is connected with the mobile phone which is used for wireless data communications via Bluetooth 4.1 . It utilises radio frequency links as opposed to wires to allow flexibility of user (AES 2002). The watch supports Wi-Fi as well and it enables the user to make use of Internet features by connecting to a wireless network, additionally to the established Bluetooth connection. The Samsung Gear S uses the operating system Tizen. The mobile phone used in this work is the Samsung Galaxy S4 Mini which is displayed in the picture 3.9. The screen size is 10,85 cm and it has a resolution of 960x540 pixels. The batteries allow an internet usage time of 9 hours, if the 3G (third generation of mobile communications technology) is used. In contrast to 2G (second generation of mobile communications technology), 3G enables the user to surf the net faster, though it consumes more energy. The mobile phone makes use of the operating system Android 4.2 and Bluetooth 4.0. It is possible to connect the device with a computer by using an USB cable; for example to develop an application.

Figure 2.1.: The Samsung Galaxy S4 Mini mobile phone (Samsung 2015*a*).

Figure 2.2.: The Samsung Gear S wristwatch (Samsung 2015*b*).

2.2. Different Types of Gear Applications

A Gear application has two parts. The mobile phone contains a software called the Gear Manager that can communicate with the watch. Its main function is to provide the service by sending information and files to the Samsung Gear S and is called the 'host-side'. On the other hand, the watch takes a consumer role and receives or displays the sent data from the mobile phone. This is also referred to as 'wearable-side'. Both devices can interact with each other or exchange data through a Bluetooth connection and the Samsung Accessory Framework.

There are three types of applications that can be created: Linked (Master-Follower),

Developing for Android Integrated and Standalone. The first one is used if the host and the wearable application are installed separately and not together. Use of this type is made if the host program is not mandatory. If an Integrated application is downloaded, it installs the host-side application and the wearable widget at the same time. This type should be used if both parts are dependent on each other. For example, the host-side application connects to the internet to get the necessary information and sends them to the wearable widget of the Samsung Gear. The third possibility is the Standalone version. This type does not require a connection to any other device. An example of this is an application that shows a clock.

For this work, an Integrated type will be used. The Samsung Galaxy S4 Mini gets the host-side application and it is responsible for retrieving the necessary data from Adobe Analytics. The Samsung Gear S receives the wearable-side widget and has the main task to inform the user if an anomaly or alert is detected. The application for the mobile phone can be created by using a tool for developing an Android program. To create a wearable-side widget, a tool for the construction of a program for a Samsung Gear S must be used (Co 2015).

Tizen is an open-source and Linux-based operating system that has been created by a community of developers with mobile and connected devices as targets. The main infrastructure is Tizen Common , which is separated into various profiles based on the purpose. For the Samsung Gear S, Tizen Wearable is used. Other examples of this are Tizen TV or Tizen IVI (in-vehicle infotainment). As the Tizen project is open, developers can contribute to it and its focus is on the platform independent HTML5 (hyptertext markup language). For the layout of the applications, Tizen contains a Web engine with an integrated rendering engine to display HTML, images and formatted content with CSS (cascading style sheets). An additional JavaScript engine interprets and executes JavaScript (Tizen 2014).

There are two ways to create a Samsung Gear application. First, a standalone program. Its use implies that the application on the watch does not need an active connection to any other device for its functions. So the program is created only for the Tizen-based device. The display of an analogue clock is one example. Another is a companion program which developers can create. The mobile device takes on the role of host and is responsible to provide and to run services for the watch. This is also called 'hostside spplication'. Whereas the Samsung Gear has a consumer function. In this work the second mentioned method is used.

As mentioned before the Tizen SDK for wearables is used to create applications with JavaScript for the Samsung Gear S. But a companion application needs a host-side part for the mobile phone as well. The Samsung Galaxy S4 Mini has the

operating system Android JB (Jelly Bean) installed. Two tools for the development were on the shortlist: Android Studio and Eclipse. Google's Android Studio shall be taken when the focus is on the creation on applications for Android mobile devices and it automatically supports devices from Google. With Eclipse, platform independent programs are created and the programming language used is Java. This means that the application will work on different operating systems like Linux, Windows or Mac OS. The creation of two simple example projects showed that Eclipse Java EE IDE (integrated development environment) for Web Developers has better usability and structure. Additionally, the Tizen SDK for wearables is an Eclipse-based IDE that facilitates the interaction between the two programs. Eclipse must have the Android plugin installed in order to be used for the development of an Android application. More information about the installation processes for the Tizen SDK for Wearables and the Eclipse Java EE IDE are available in the appendix. For the development of a Gear application, the Samsung Accessory SDK (Software Development Kit) for a host-side provider application and the Tizen SDK for a wearable-side consumer are used. An application programming interface (API) contains the rules of how to deal with an application whereas a software development kit (SDK) has the components to make an application. With an Integrated type of application, the host-side provider controls the consumer widget. If the Samsung mobile phone has a provider and the Samsung watch a consumer service of the same profile, the Samsung Accessory Framework can generate a connection between them. The profile must be implemented in the XML (Extensible Markup Language) file and contains the connection details like application name and role to define if it is a consumer or a provider. The host-side application contains the SASocket subclass to establish the connection between the devices and is integrated in the SAAgent class that contains the main functionalities. The wearable-side widget searches and connects with the SAAgent from the provider and the communication is settled via the SASocket (Nadoba 2014).

The design of an user interface must provide a high usability. A common method to create a first model of the application is called a mockup. It displays only some or the most important functions, should give a first overview of the program and facilitates the testing process. Online tools like mockups provide a platform where an example application can be created without programming a line of code. So the main advantage is that an application can be created quicker by visualising the idea in a graphical form before starting to create it. In her article about the usability engineering lifecycle, Mayhew discusses the fact that people want to have a powerful functionality and a simple and clear interface. She sees the design of the model mockups right after the settings of the design and goals (Mayhew 1999).

3. Developing an Android Host and a Tizen Client Application

The next examples show how a basic Tizen and Android application is created. Based on these programs, the used features and concepts are explained in detail. The corresponding code is attached in the appendix. The first simple application demonstrates how to display text on the wristwatch and the second one shows the display on an Android mobile phone.

3.1. Proof of Concept

The first step to create a Tizen application is to install the Tizen SDK. The supported operating systems are Ubuntu, Windows and Mac OS. A detailed introduction of the installation process is available in the appendix. It is possible to save the Tizen projects to a different folder by specifying a specific workspace. This is for example the home directory. Every created project and file will be saved into this folder. Afterwards, the application can be created in the tool by using a template or a sample. The Project Wizard will automatically add the basic functions. It is mandatory that the chosen project name must be between 2 and 49 characters in length and only these characters are allowed: a-z, A-Z and 0-9. It is recommended to avoid spaces in the project name as it leads to errors in the application. For this example project a Wearable UI is sufficient, because the basic application will only display text. Another accessible template is the 'IME' application which is an acronym for 'Input Method Editor'. It is usable for receiving user interactions with the help of various forms. Once the application is created by the Project Wizard, the basic code can be edited easily. The 'index.html' file must be changed to generate a different text output on the watch.

It is not required to have a Samsung device for the creation of a Tizen application. A generated virtual device that has the characteristics of the device to be copied can display the program and is used for the testing process. This is called an emulator. That tool emulates the target device and establishes an environment in which to test programs. Tizen SDK provides an Emulator Manager to generate and access the virtual device. SDB (Smart Development Bridge) is used to establish a connection with the emulator or a physical device. The tool

is responsible to manage more device connections and to provide some basic commands, like a file transfer. To enable SDB e.g. for a mobile device, the USB debugging and the needed drivers must be activated or installed. Mostly, these are found automatically if the device is accessed with the computer. USB debugging moves the mobile phone into a debugging-mode by connecting it via USB cable. This enables the creation or changing of files on the phone, and applications like 'MyPhoneExplorer' can be managed from the computer. It is recommended to disable this feature after usage, because it can be used to crack the phone based on patterns. Android gives no warning whether it is activated or not (Wekenborg 2013).

Figure 3.1 demonstrates the example settings for the Tizen Emulator Manager for a Samsung Gear S watch. The following picture 3.2 shows an example output of the program.

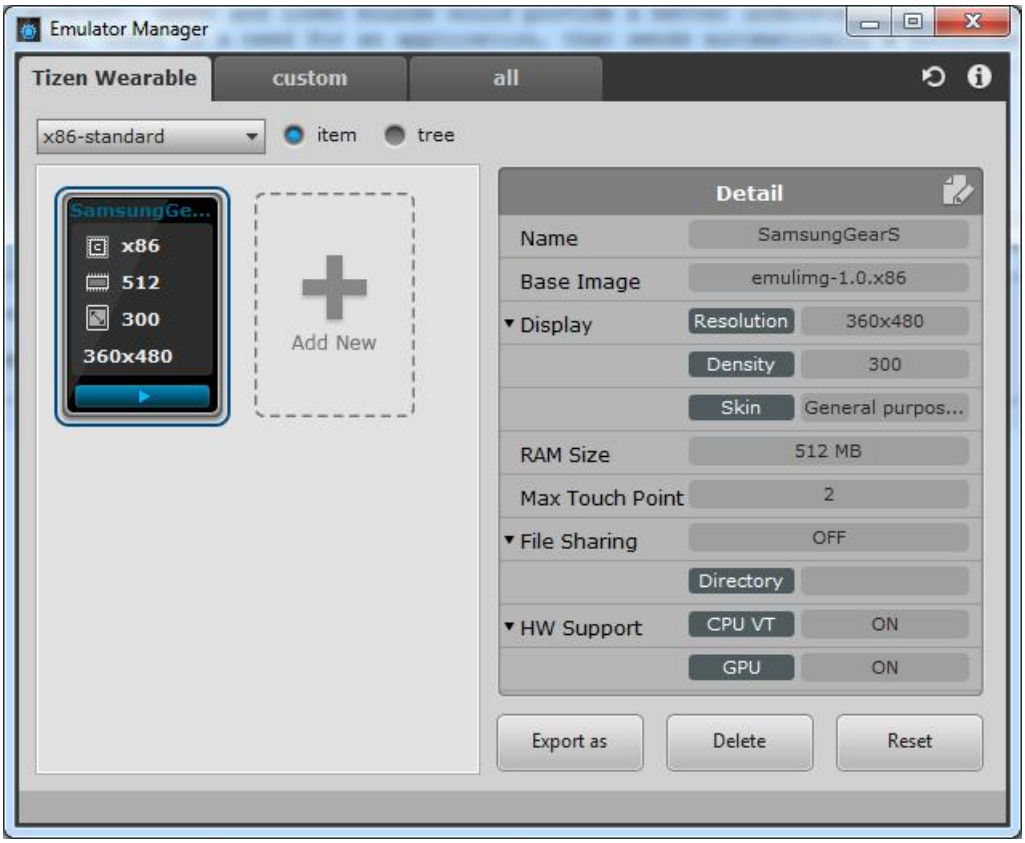


Figure 3.1.: Virtual device settings for an emulator that substitues a Samsung Gear S.

Figure 3.2.: Output of a simple Tizen Gear application that displays 'Hello developers'.

This second example demonstrates the utilization of the software development tool Eclipse in combination with a simple application that displays 'Hello developers' on a mobile device. Additional information about the installation of Eclipse is located in the appendix. In preparing the program, the API level has important influence. It validates if the application is compatible with other Android platforms, because the level between Android devices can vary. Eclipse provides an assistant to prepare a quick application and various templates. The Android application is created as a project and must be assigned to a minimum required SDK and a target SDK. The difference between these two versions is that the minimum SDK version is mandatory for the user to be able to install the application. Whereas the target SDK states the API level that is aimed by the application and that is successfully tested. An API level is an integer and is supported by only one Android platform. Therefore, an application can run with every API level between the minimum and the target SDK. If the given target SDK version is lower than the API level of the platform, the application remains operational via the automatic compatibility feature. During the installation of an application, the minimum SDK version that is saved inside the program is checked. If the value is lower than the minimum SDK version, the application will not be allowed to install (Developer 2015a).

For example, the Gingerbread or Android 2.3 platform is available for download and contains new features like a multiple camera support. Android 2.3 is assigned to the identifier API level 9 that is used to check, if the applications are compatible with this platform. A crash of the program is avoided, because the check is executed during the installation. Before a software development tool is selectable it must be downloaded. Eclipse provides the SDK Manager for an automatic

download of the necessary files. Each application must have a unique identifier which is called package name. It is set during the creation of the project and is not editable afterwards.

A simple Android application can be created by using an assistant that automatically generates the needed files based on the entered data. For an Android device, like Samsung Galaxy S4 Mini, an Android project must be created. It is located inside the 'Project...' menu item. The needed project type for a simple application that displays only 'Hello developers!' is 'Android Application Project'. Another option is 'Android Sample Project', but this type requires that the package 'Samples for SDK' is installed. These SDK samples provide various examples that show some special features for Android. For beginners, it is recommended to create the a project with the sample called 'ApiDemos' and to launch it on the mobile phone to see the output of the various examples. Once all settings are entered, the project can be tested.

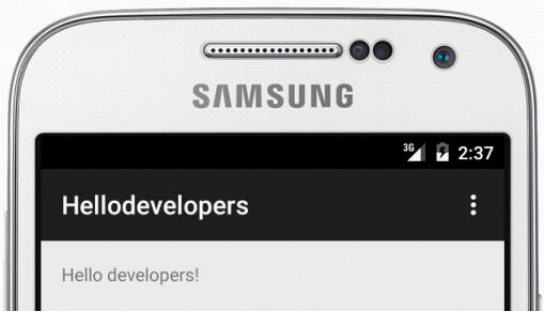


Figure 3.3.: Output of a simple Eclipse application that displays 'Hello developers'.

The picture 3.3 shows the generated sample program for the Samsung Galaxy S4 Mini. It displays 'Hello developers!' if the application is executed. The application is testable on a virtual or physical device. The first option implies some previously conducted installations and settings. Firstly, the device must be added to the computer and all the drivers must be installed. A driver establishes a connection between the computer and any other hardware device. For example, a computer needs a specific printer driver to be able to send and receive documents from the printer. Secondly, the mobile phone must have 'USB debugging' enabled to receive the application and to run it. This is a hidden feature and must be enabled manually to avoid that a user activates it accidentally. The following process must be successfully completed in order to enable the feature: With a Samsung Galaxy S4 Mini the user needs to navigate to the settings for developers. Inside this section, 'USB debugging' can be activated by enabling the checkbox. Thirdly, the OEM (original equipment

manufacturers) USB Driver must be installed on the computer. It is required if an application needs to be tested on an Android device. Once all three adjustments have been effected, the mobile phone will appear in the Android device selector if it is connected with the computer via a Bluetooth connection. The second option is to run the application in an emulator. The Samsung Galaxy S4 Mini is a newer type of mobile phone and is not preinstalled in Eclipse. Therefore, developer Cyril created some emulators for newer mobile phone models. It is possible to download them for free and to then make use of them in Eclipse (Real 2014). In the run configuration, the target is set to the appropriate virtual device. If the needed mobile phone is not listed, it can be imported with the Virtual Device Manager. There is also a clone function available, if a new device cannot be created.

During the creation of this example, three errors occurred. First, an error was shown when a new application is created. The author Lazy discusses the appearance of a 'parseSdkContent failed' message on the question and answer website Stack Overflow. It is advised to delete the 'home/.android' folder which can be found in Windows at this location: 'C:/User/User'. Lazy draws the conclusion that the error message occurred because of two existing SDKs on the computer. If one version is opened, then the other version will receive the error, because both use the same .android file. This file is created after an installation of an Android SDK and is the default location for the configuration files of the Android Virtual Devices (Lazy 2014).

The size of an Android SDK version is very large. Therefore, the author DariuszB discusses the relocation of the storage location from the different Android SDKs to a different drive. If a computer for example has more than one activated storage disk, a user can choose on which storage the data should be saved. But it is important to inform the system where the new file is located. Therefore, an environment variable called 'ANDROID SDKHOME' must be created and its value should be set to the new path like 'E:
Android'. Environment variables give programs information like the computer name or the current working directory. A common variable that is used by a lot of programs to check the location of needed sources is 'PATH'. The programs automatically search through the listed paths inside this variable (DariuszB 2010).

Secondly, there was yet another error published after the import of an external application. Existing programs that are organized and have the structure like Eclipse projects are opened in Eclipse with the import function in the main menu. The tool compares the SDK version from Eclipse and from the imported application. If both versions do not fit together, an error occurs. For example, the loaded program uses the API level 20, but Eclipse uses version 18. Then the error states: "Unable

to resolve target 'android20'". To solve the problem, the SDK Manager (a separate application and available in the 'Window' item of the menu) must be opened. With this tool, the SDK version with the appropriate API level can be updated or installed. This enables the user to install the 'Android 4.4W.2 (API20)' and the error in the example will not show up again.

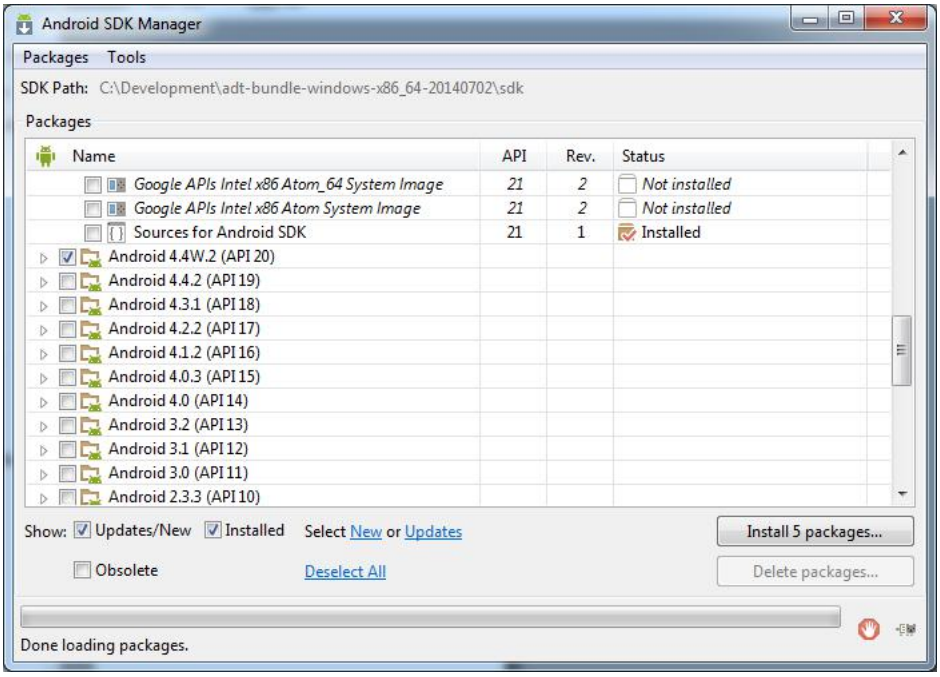


Figure 3.4.: SDK Manager from Eclipse to install other or additional API levels.

The image 3.4 shows the SDK Manager from Android. As described in the previous paragraph, the tool is exists apart from Eclipse. Therefore, it is also possible to open it in the Android SDK folder by starting 'SDK Manager.exe'. A package or SDK is downloadable by enabling the respective checkbox of the item and clicking the 'Install'button. It is important to download specific tools and packages to be able to develop for Android with Eclipse. Further information can be read in the appendix.

Thirdly, the last shown error is `\T1\textquotedblleft...\HelloWorldExample\res\values\styles.xml:7:error:Errorretrievingparentforitem:Noresourcefoundthatmatchesthegivenname'Theme.AppCompat.Light'\T1\textquotedblright`. The solution of this problem is discussed by Andr-oid Eric in an article for Android development beginners. He explains the use of a

support library. An Android support library is mostly used to make older Android API versions available. This is an advantage if the project uses more APIs to use specific layout features and to reach more customers. For example, the author of the article wants to use the ActionBar. This is a feature that provides navigation and user action functions. According to Android developers, "The ActionBar APIs were first added in Android 3.0 (API level 11) but they are also available in the Support Library for compatibility with Android 2.1 (API level 7) and above." (Developer 2015b) Therefore, the author of the article recommends to add the 'appcompat v7' Support Library to the project in order to be able to make use of the ActionBar. Inside the SDK Manager, the package for the 'Android Support Library' must be downloaded to be able to make use of support libraries (Eric 2013). There is a possibility to check afterwards if the inserted project is a library. If this is the case, then inside the Android settings the project is marked as 'Is Library', proving that it was successfully added as a library. But adding a support library to Eclipse does not automatically imply that the main project recognizes it. Therefore, a reference must be created. A connection between these two items is generated by adding a library in the Android settings of the main project. Afterwards, the error is solved and the additional features can be used.

3.2. Developing an Alarm System for Adobe SiteCatalyst

The previous subchapters displayed sample applications in order to give a first introduction of the creation of a Tizen and Android program. This chapter is about the creation of an Android host and Tizen client application to generate an alarm system for the Anomaly Detection reports from Adobe Analytics for the devices Samsung Galaxy S4 Mini and the Samsung Gear S wristwatch. The course of events for the application can be divided roughly into these phases 3.5.

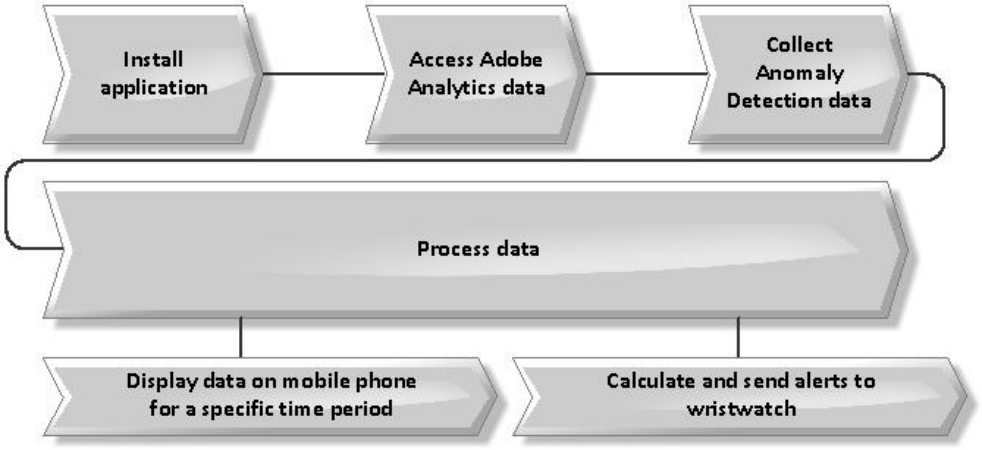


Figure 3.5.: Process diagram shows the sequence of the individual steps to generate an alarm system.

The user needs to install the app and then to open it. The application accesses the data from a specific report suite from Adobe Analytics. Additional information about how to generate and enable an external access to the data is indicated in the Appendix. Afterwards, the data from Anomaly Detection reports is gathered to process the data thereafter. On the one hand, the received information is graphically displayed on the mobile phone for a specific time period. On the other hand, if an error in the dataset is detected or calculated, an alert must be sent to the Samsung Gear S wristwatch to inform the consumer.

In conjunction with a Gear application, the main program is split into two pieces: the Android host and the Tizen or Gear client part. The Samsung mobile phone contains the Gear Manager that is connected with the WearableManagerService on the wristwatch. The Manager also sends the wearable-side widget that is saved inside the host application to the Samsung Gear. Afterwards, the WearableManagerService installs the widget on the watch. A widget is a program that provides information for or retrieves information from the user. For example, upcoming calendar events are widgets. On one hand, the provider for example contains the service that connects with the widget, the widget itself, the settings for the service and layout. On the other hand, the client includes the settings and functions of the widget, the application and the layout of the project for the watch. The next picture sums up the process of the construction of a Gear application.

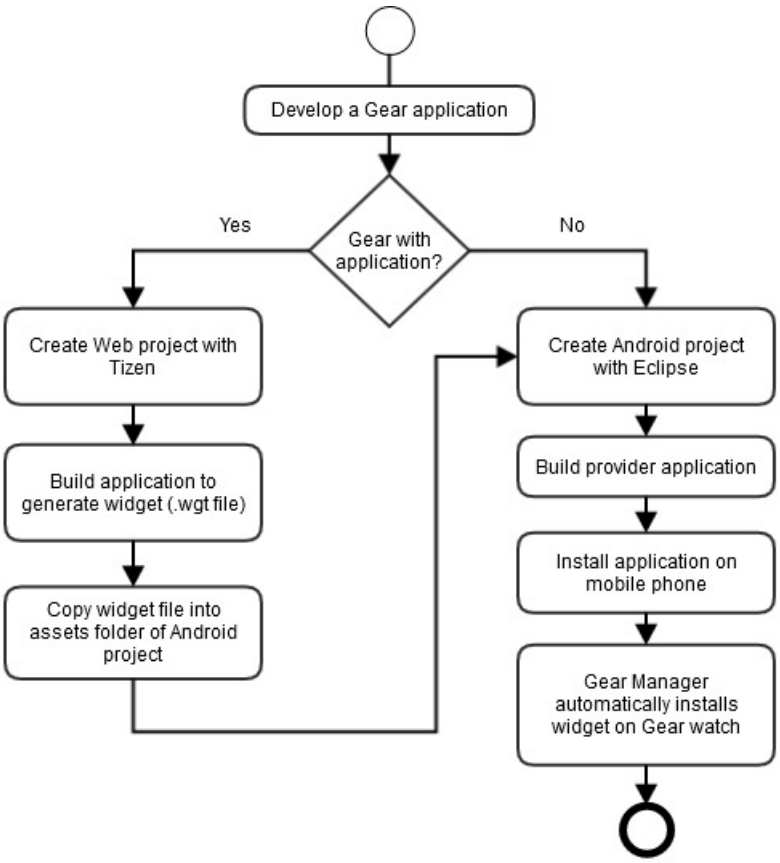


Figure 3.6.: The diagram shows two different types to generate a Gear application. The main di erence is that if no user interface is needed on the wristwatch, then no Tizen consumer widget needs to be created.

Picture 3.6 shows two different ways of how a Gear application can be created. It depends on whether the client part contains a separate application with a user interface or not. This work does not focus on the creation of a consumer widget, because a special notification feature from Samsung is used. Nevertheless, if a user interface is to be created with Tizen SDK for Wearables, it is mandatory to build the application first. Only then, a suitable wgt (widget) consumer file is generated. This file must be imported into the assets folder in the Android project from Eclipse, if the developer wants to have it installed automatically with the installation of the host application. Samsung provides the feature Rich Notifications for the Gear S model. This enables the developer to inform the customer about specific events. Additionally it is possible to personalize the occurrence of the notifications. With this SDK it is also feasible

to receive a response from the user and the customer can interact with the provider server. The appearance of the notification is changeable and additional options can be added to it. To make use of the Samsung Rich Notifications, three libraries must be added to the Java project in Eclipse: richnotification-v1.0.0.jar, sdkv1.0.0.jar and gson-2.2.4.jar(or later version of gson) file. The first compressed library file contains the main libraries for the client and the second one is needed to use the Samsung SDK. Gson is used to transform Java objects into JSON (JavaScript Object Notation) and back. JSON is used to bring code in a readable form. If the SDK Rich Notifications is chosen and the developer does not need a separate widget on the watch, it is not necessary to develop a Tizen application. It is sufficient to add the previously mentioned libraries to the Java application in Eclipse to get access to the required features like the notifications. Mockups are a useful aid for creative purposes like the design.

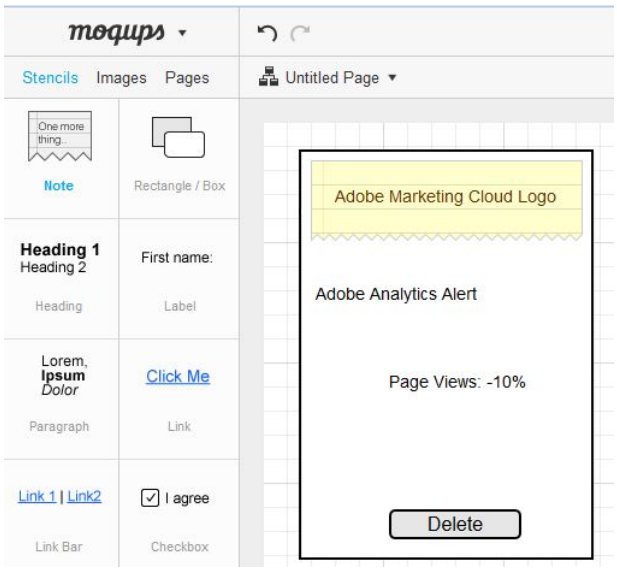


Figure 3.7.: A simple user interface created with the online tool moqups without writing any code.

The pattern 3.7 shows an example of how to design an alert for a Samsung Gear S wristwatch. Various elements are available to support the developer during the design phase. With the online tool moqups, it is also possible to add functions behind some elements. Consequently, not only a single page can be modelled, but also a process. For example, if the consumer clicks on the button, an automatic redirect takes the user to the notification overview page. Once the design is set, the application can be created in Eclipse with Java.

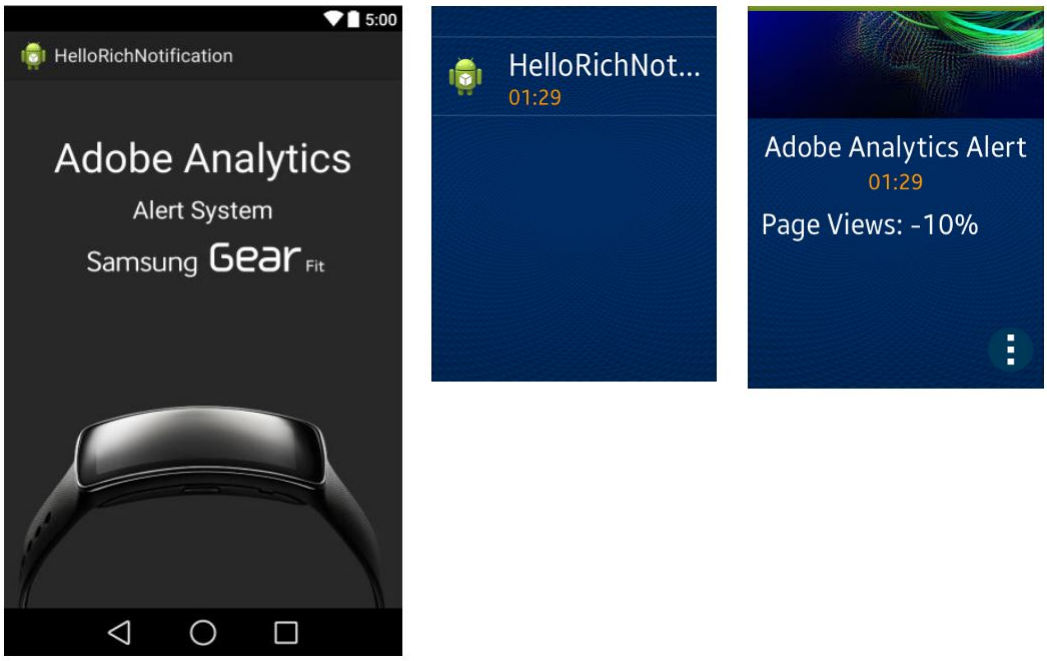


Figure 3.8.: The picture demonstrates the use of the RichNotification SDK provided by Samsung in combination with alerts. The image on the left shows the Android application on the mobile phone that contains the logic for the notifications. The other two pictures demonstrate how the messages displayed on a Samsung Gear (Systems 2015*a*).

The images in figure 3.8 show a sample Rich Notification program based on the explanations from the Samsung Developers platform. The service provider is the Android host application that contains the main logic. It must be installed on the Samsung Galaxy S4 Mini and automatically sends a notification to the Samsung Gear S. Once the message is received, it is opened and displayed immediately. The second picture shows that the message is placed in the section where all notification of the watch are displayed after the message was ignored or inspected. In this area, it can be deleted too. The third Image shows the content of the notification. The little picture in the bottom right with the three dots opens a settings menu with the choice to delete the notification immediately. The content of it contains an alert from the tool Adobe Analytics, that states that the overall page calls from a website are decreased by 10% based on the Anomaly Detection from Adobe. Further information about the calculation of the anomalies are available in the chapter (Developers 2014).

The path now heads from the notification creation to the creation of a host ap-

plication that should provide the main service. The first step is to create an Android application in Eclipse that generates an external access to the stored data from Adobe Analytics which should be monitored. For this purpose, the software system Analytics Reporting API exists. The method to interact with it over the Internet is called Web services. In order to access Web services, two main protocols are often used: SOAP (Simple Object Access Protocol) and REST (Representational State Transfer). A protocol has a combination of rules for requesting servers to set up a standard, for example to exchange information. SOAP is a platform independent protocol that enables the communication between different applications. It depends on XML and it is possible to enlarge it with security features to authenticate on a secure website. An important file that is always listed together with SOAP is WSDL (Web Services Description Language). This XML document at issue among other things also describes the web service and the way of access. A Web service thus uses XML to describe data, SOAP to transfer a message and finally WSDL to describe the availability of services (Noabeb 2015). The main disadvantage of SOAP is that it is necessary to write the XML structure for every task. As far as the prevention of complexity is concerned, REST provides a simpler solution because it uses an URL-based approach and therefore, does not need XML for the communication. The next two code examples will show how to use these protocols.

Mueller discusses two simple examples based on the free Web service 'geocoder.us'. The provider retrieves the specific information of a location like latitude and longitude for the United States. The data it retrieved was collected by the US Census Bureau, which is among other responsibilities accountable for the United States Census (Wikipedia 2015*d*). The first example shows a simple REST application. An URL is generated with the necessary parameters and values to limit the requested data.

```
http://rpc.geocoder.us/service/csv?address=1600+Pennsylvania+Ave,
+Washington+DC
```

If the URL is entered in the browser, the response will be in a CSV (comma-separated value) format and contain the latitude and then the longitude. With these two values, any place on the earth can be localized precisely. The same example is explained for SOAP in combination with a WSDL file from Wickstrom.

```
1  // Tested with PHP 5.2.4
2
3  // The address to convert
4  $address = '1600 Pennsylvania Av, Washington, DC';
5  printf("Get geocode for address: %s\n",$address);
6
7  // Chose your method, with or without user info
8  $wsdl = 'http://geocoder.us/dist/eg/clients/GeoCoderPHP.wsdl';
9  //$wsdl = 'http://username:password@geocoder.us/dist/eg/clients/GeoCoderPHP.wsdl';
10
11 // Make the connection
12 $client = new SoapClient($wsdl);
13
14 // Use this to see what services are available
15 //var_dump($client->__getFunctions());
16
17 // Actually call the service
18 $result = $client->geocode($address);
19 var_dump($result);
```

The author creates a simple PHP (Hypertext Preprocessor) file. It is a scripting language and used for creating websites or web applications. The example script saves the address, adds the location of the WSDL file and opens a connection with the help of the WSDL file to the server from 'geocoder.us'. The following function from Wickstrom shows how to list all available functions from the web service. At the end of the script, the function geocode() returns a list with the results from the query that again contains the latitude and longitude of the given address (Wickstrom 2005).

The author Mueller makes a summary of the significant differences between SOAP and REST in his article based on their comparative advantages. On one hand, SOAP does not need a specific transport protocol like HTTP (Hypertext Transfer Protocol) that is responsible for the transfer of data between applications. Additionally, it has a built-in error handling and is standardized. Further extensions enable the usage of special features based on the WS standard like WS-Security. Web Services with SOAP/WSDL uses the industrial standards from WS-* classes to add functionality. On the other hand, REST is easier to use and it has a smaller format, because it does not need XML for the communication (Mueller 2013).

Based on the given facts and results, the REST method is used in this work to access the data from Adobe Analytics. It is not only more readable than SOAP, but the structure is also less confusing. The next step after down from the Web service decision is to build the service provider application in Eclipse. The following images show the predefined design for the main page that appears after the application is called up as well as the real page.

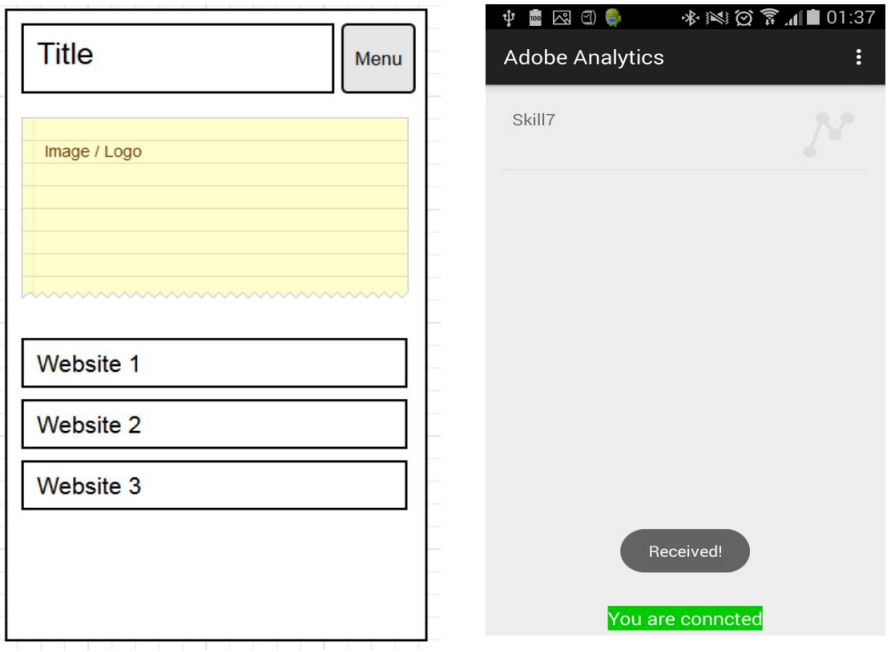


Figure 3.9.: The left picture shows the prede ned user interface for the start page and the right picture the user interface for the start page put into practice.

3.9 The user needs to install the app and then to open it. The first page shows a list of the available report suites that should be examined in order to detect any abnormalities in the data. Located in the menu's upper right corner is a symbol with three dots. A click on this item opens the page where the adjustment of the alerts are situated. For example, a click on one of the buttons will start and stop the notification application. This feature is not mandatory, because the consumer can quit the application anytime. But if the application should be executed in the background for a longer period of time, this feature will have a higher degree of importance.

Once the application is opened, it starts to make the first requests to Adobe Analytics. At the bottom, a green rectangle with the text 'You are connected' is placed. This element gives information about if there is a working Internet connection or not. If the data is successfully received, a pop-up message is displayed to inform the developer. This type of notification is called a toast and its characteristic is that it does not contain any buttons and that it disappears after a specific period of time. The received data needs to be converted before it can be used. The type of the returned information is JSON.

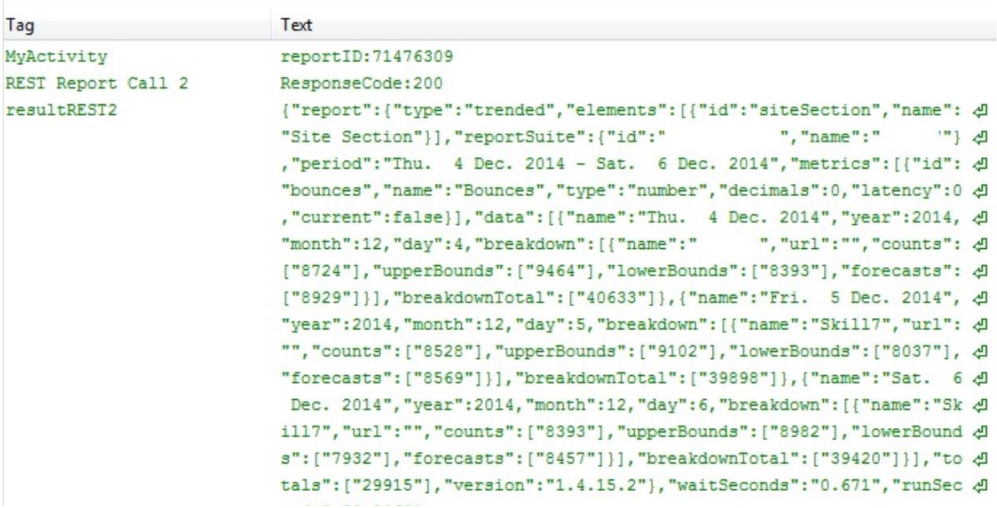


Figure 3.10.: The content from variables can be displayed in a console application. The picture shows the structure of the response from the Adobe Reporting API

The figure 3.10 shows the example response from the Adobe Reporting API. The long text next to the tag 'resultREST2' has the format JSON and must be converted for further usage. An article from the website 'secretgeek.net' discusses the use and function of JSON (JavaScript Object Notation). As the picture demonstrates, it is used to send an object in a nested structure. The author explains that the curved brackets are used as a container and square brackets include arrays. As separator between values a colon is used whereas arrays are separated by commas. An array is a collection of indexed variables (Secretgeek 2006). To deal with this data response type, an external JSON library is added from Java2s. If it is implemented in the code, the predefined functions make the conversion between the formats easier and the code gets shorter (Java2s 2015). After the data is transformed, it can be displayed in a diagram.

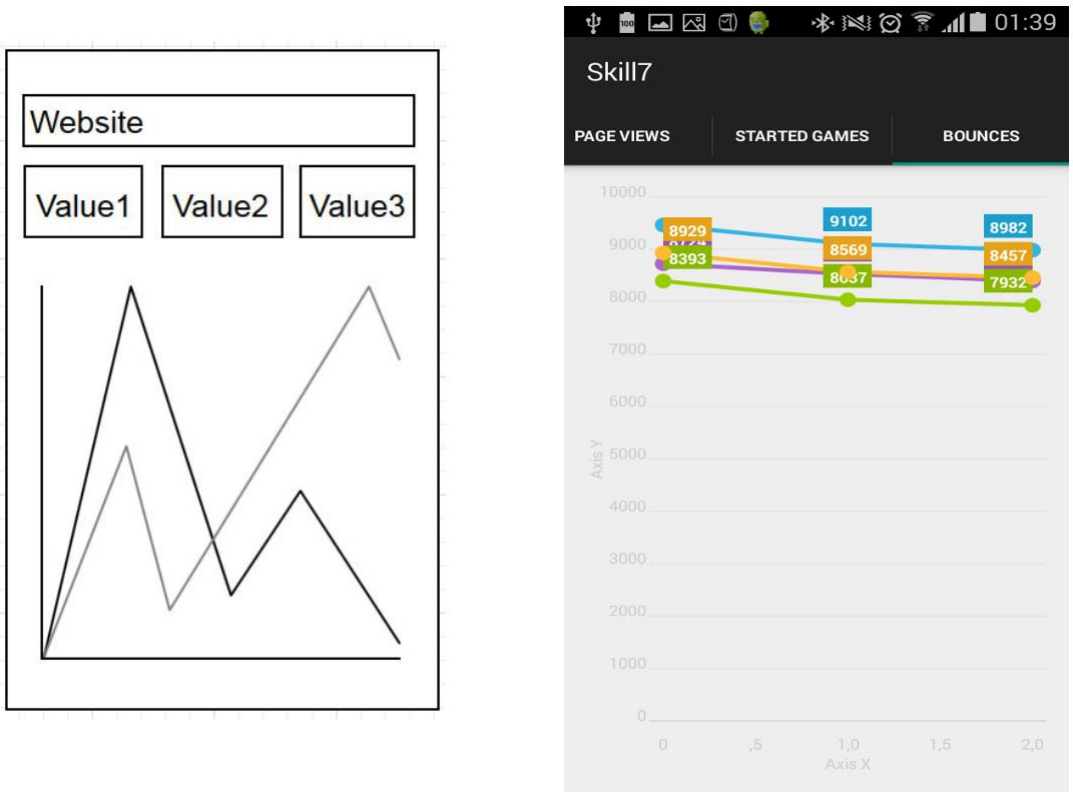


Figure 3.11.: The picture on the left side shows a design for the page that should display the values from the Adobe Anomaly Detection reports. Whereas the picture on the right side shows the user interface for the display of the Adobe Anomaly Detection reports put into practise with the HelloCharts library.

The above pictures 3.11 show the appearance of the data from the Adobe Anomaly Detection in a chart. To display the data in a diagram, a tool or external library for an Android device is needed. The search for an appropriate solution revealed open source and commercial charting software. Examples for open source software are: Holo Graph Library, ChartView and HelloCharts and for commercial software are: Rchart, Orson Charts and Telerik Rad Chart.

It is necessary to know the requirements of the information display to take a decision for the appropriate software or library. For this work, the targets are separated into more parts. For example, the charts should be able to automatically

adjust their size based on the screen resolution of the mobile phone. The functionality should remain the same and the colours should not differ too much in order to create a higher recognition value to Adobe Analytics. Another main factor is the availability of line charts, as it is the most effective way to display data of a time series. For such purposes, the x-axis will display the date and the y-axis will display the figures based on the report. As the received data from Adobe's Anomaly Detection contains four different values, four different lines must be created. A lot of charts have a limit of the lines in a chart. But a consumer needs to see past and future data to make a sound decision. Because it is very difficult to make an estimation about the performance of value, if only one figure is given without a context.

A charting software must provide a lot of different chart types and should exhibit the feature to change the chart type without any big effort, because company guidelines can rapidly change. If the library does not support the new chart types, a new kind of data visualisation must be integrated. This inevitably increases costs, as development and staff expenditure for the new charting software are incremented. Unfortunately, some people believe that they can see how much the graphic tool is worth based on its appearance and presentation. Graphs that look as if they have been created with old and cheap tools are often refused due to this way of thinking. In addition, there are different types of guidelines for a more efficient creation of reports. Companies like HICHERT+FAISST AG are specialised in this area. One of the recent findings is the avoidance of pie charts as steadily more managers are not able to correctly evaluate the range of the elements within them (HICHERT+FAISST 2015).

The final requirement is the easy handling of the charts from a development and an end-user point of view. Due to the fact that the code should be easy to read and to extend, it is important that no massively cumbersome techniques are used for the creation of the charts. Thus, a new developer can easily understand the code and the functionality without any previous knowledge. Moreover, it reduces the amount of time that is needed to begin the learning process of the structure of the code from scratch.

Based on the given requirements, the library HelloCharts was chosen, because it provides special features like to swipe through register cards. It is possible to change the type of the chart from a pie to a line chart by merely changing its name Also, the library contains some interactive features like an immediate change of a diagram, if the connected diagram changes. For example, a column and a line diagram are connected with each other. If one day of the column chart is chosen, the line chart can display the values for this day per hour. The fact that it does only work with an API Level greater than or equal to eight is not an obstacle as the

recent API level is 21 and the project will likewise be created with the most recent level. Its terms and conditions of use are listed under the Apache License Version 2.0. Based on the terms, the software can be combined with other products and sold as packages. HelloCharts is used as a charting library by defining the chart view in the layout XML file. Alternatively, the view can be created and the layout associated later. The necessary diagram methods or functions are accessible via the chart classes and the appearance is changeable with the methods from the data model. Every point in the chart is set with a an array-list. Therefore, every point is accessible via an x-axis and and y-axis value (Wach 2015).

Therefore, the service provider uses this library as a charting software for the values of the Anomaly Detection from Adobe. The picture shows three different values: page views, started games and bounces. To display the second vertical category that displays the started games, the consumer only needs to swipe from right to the left side or tap on the tab. These three different values were selected because they reflect the performance of the website. A page view is triggered every time if a page with implemented Adobe Analytics code is loaded. Valela discusses in his article the use of page views and their importance in the marketing area. According to his writing, page views are used to validate an advertising media. A marketing manager's task is to increase the number of page views in order to increase the value advertisement views (Valela 2014). The second tab contains a figure that displays the performance of the sold product. As the success of a company is tied to sales of the core product, the achievement of this goal must be monitored. The last value that is displayed graphically is bounces. This value indicates how the number of single requests behave on the website. For example, if a consumer opens the website and does not interact any further with it than to leave it, then this single request is calculated as a bounce. A high number of bounces can be an indicator of wrong marketing strategies, because the users which have been to the website are leaving right after the first page view.

4. Conclusion and Further Research

In summary, the available final results show that it is possible to create a working Gear application with moderate resource requirements. The target of this work was to develop an Android Host client that can retrieve the information from the external tool Adobe Analytics via web services and to send errors or alerts to a Gear. This program will help to manage the process of data collection, because the created alert application monitors the incoming traffic. Building on this point, it would be useful to add additional features to application. For example, a consumer is more flexible in the data analysis, if the monitored variables are not defined as fix, but selectable. The connection between the Samsung Gear S watch and the Samsung Galaxy S4 Mini revealed no problems and has always worked well. The main reason of this unproblematic coupling of the two devices is the straightforward Gear Manager which provides a simple user interface to organize applications on the watch.

Bibliography

AES (2002), 'Bluetooth and wireless networking a primer for audio engineers'. http://www.aes.org/journal/sampleissue/JAESV5011PG979.pdf.

Androidxda (2015), 'Download samsung usb drivers'. http://androidxda.com/download-samsung-usb-drivers.

Avast (2015), 'avast! be free'. https://www.avast.com/index.

Co, S. E. (2015), 'Samsung gear application, hello accessory developer's guide,'. http://developer.samsung.com/technical-doc/view.do?v=T000000160.

Crowd, G. (2015), 'Digital analytics scale score'. https://www.g2crowd.com/categories/digital-analytics/.

DariuszB (2010), 'Moving default avd configuration folder (.android)'. http://stackoverflow.com/questions/3109473/moving-default-avd-configuration-folder-android.

Developer, A. (2015a), 'Api levels'. https://developer.android.com/guide/topics/manifest/uses-sdk-element.html.

Developer, A. (2015b), 'Action bar'. https://developer.android.com/guide/topics/ui/actionbar.html.

Developer, A. (2015c), 'Installing the eclipse plugin'. http://developer.android.com/sdk/installing/installing-adt.html.

Developers, S. (2014), 'Basic rich notification development'. http://developer.samsung.com/what-is-new/blog/2014/Tutorial-Basic-Rich-Notification-Development.

Eclipse (2015), 'Eclipse ide for java ee developers'. https://eclipse.org/downloads/packages/eclipse-ide-java-ee-developers/lunasr2.

Eric, A. (2013), 'Create library project with the appcompat v7 support library'. http://android-er.blogspot.co.at/2013/12/create-library-project-with-appcompat.html.

Google (2014), 'Google analytics terms'. http://www.google.com/analytics/terms/us.html.

HICHERT+FAISST (2015), 'Chamber of horrors > charts > circles'. http://www.hichert.com/en/_media.html?id=74.

Idugboe, D. (2014), 'What is digital marketing and what you need to know about it today'. http://www.smedio.com/what-is-digital-marketing/.

Java2s (2015), 'Download link'. http://www.java2s.com/Code/JarDownload/java/java-json.jar.zip.

Kalekar, P. S. (2004), 'Anomaly detection'. http://labs.omniti.com/people/jesus/papers/holtwinters.pdf.

Kates, M. (2013), 'Making digital and traditional marketing work together'. http://econsultancy.com/au/blog/62546-making-digital-and-traditional-marketing-work-together.

Kaushik, A. (2007), 'Web analytics: An hour a day.'. None.

Lazy (2014), 'parsesdkcontent failed could not initialize class andrlid.graphics.typeface'. http://stackoverflow.com/questions/24636393/parsesdkcontent-failed-could-not-initialize-class-android-graphics-typeface.

Mayhew, D. J. (1999), 'The usability engineering lifecycle.'. In: CHI'99 Extended Abstracts on Human Factors in Computing Systems. ACM, 1999. S. 147-148.

Mueller, J. (2013), 'Understanding soap and rest basics'. http://blog.smartbear.com/apis/understanding-soap-and-rest-basics/.

Nadoba, A. (2014), 'Developing your first tizen galaxy gear2 app – tips'. http://blog.scalac.io/2014/07/30/developing-your-first-galaxy-gear-app.html.

Noabeb, L. (2015), 'Anatomy of a web service: Xml, soap and wsdl for platform-independent data exchange'. http://www.webreference.com/authoring/web_service/index.html.

Real, C. (2014), 'Android virtual device skins'. http://sourceforge.net/projects/android-emulator-skins/files/.

Samsung (2015*a*), 'Samsung galaxy s4 mini lte i9195.'. http://www.samsung.com/at/consumer/mobile-phone/mobile-phone/smartphones/GT-I9195ZWAATO?subsubtype=galaxy.

Samsung (2015*b*), 'Samsung gear s.'. http://www.samsung.com/global/microsite/gears/gears_design.html.

Secretgeek (2006), 'What is json: The 3 minute json tutorial'. http://www.secretgeek.net/json_3mins.

Systems, A. (2012), 'Data collection'. https://marketing.adobe.com/developer/get-started/enterprise-api/c-data-collection-overview.

Systems, A. (2015a), 'Fast facts'. http://wwwimages.adobe.com/content/dam/Adobe/en/company/pdfs/fast-facts.pdf.

Systems, A. (2015*a*), 'The most comprehensive set of digital marketing solutions.'. http://www.adobe.com/solutions/digital-marketing.html.

Systems, A. (2015b), 'Metric description'. https://marketing.adobe.com/resources/help/reference/metrics.html.

Systems, A. (2015*b*), 'Welcome to reports and analytics.'. https://www3.omniture.com/login/.

Systems, A. (2015c), 'Anomaly detection'. https://marketing.adobe.com/resources/help/reference/anomaly.html.

Tizen (2014), 'Tizen web application development for beginners, version 1.0.'. https://www.tizen.org/sites/default/files/page/tizenwebapplicationdevelopmentforbeginners.pdf.

Valela, A. (2014), 'What's more important: Page views or unique visitors?'. http://blog.agilitycms.com/content-managers/what-s-more-important-page-views-or-unique-visitors.

Wach, L. (2015), 'Github – lecho/hellocharts-android'. https://github.com/lecho/hellocharts-android.

Wekenborg, J. (2013), 'Was ist usb-debugging – und wie lässt es sich aktivieren?'. http://www.giga.de/extra/android-spezials/specials/was-ist-usb-debugging-und-wie-laesst-es-sich-aktivieren/.

Wickstrom, K. (2005), 'Calling the member service with php and the pear library'. http://geocoder.us/help/php_kenny.shtml.

Wikipedia (2015*a*), 'Eclipse (software) - wikipedia, the free encyclopedia'. http://en.wikipedia.org/wiki/Eclipse.

Wikipedia (2015*b*), 'Hardware virtualization - wikipedia, the free encyclopedia'. http://en.wikipedia.org/wiki/Hardwarevirtualization.

Wikipedia (2015*c*), 'Query string — Wikipedia, the free encyclopedia'. http://en.wikipedia.org/wiki/Querystring.

Wikipedia (2015*d*), 'United states census bureau - wikipedia, the free encyclopedia'. http://http://http://en.wikipedia.org/wiki/United_States_Census_Bureau.

A. Appendix

This chapter goes into more detail on how the different tools are installed, seeing as how this can lead to various errors. In addition, this section will provide the sample code for the main applications that are generated as part of this work.

A.1. Tizen SDK for Wearables Installation

There are are three possibilities to install the Tizen SDK: network, SDK image or command line interface installation. In this example, the software will be installed using the provided SDK image. Before the software is installed on the computer, the following system requirements must be checked:

- Ubuntu® 12.04 or 14.04 (32- or 64-bit), Microsoft Windows® 7/8 (32- or 64-bit), Apple Mac OS® X 10.8(Mountain Lion) 64-bit, 10.9(Mavericks) 64-bit.
- At least dual-core 2 GHz of CPU
- At least 3 GB of RAM memory
- At least 6 GB of free disk space
- Local administrator authority
- Oracle Java v7 or higher

The first step to install the Tizen SDK for Wearable is to open the Tizen Developers website. Two different files must be downloaded: the Install Manager and the SDK Image. The image file consists of all SDK files that are needed for an offline environment. If the operating system of the computer is Windows, then the appropriate version must be chosen in the displayed tables. Once the manager is executed, the installation process starts. If the computer has an enabled anti-virus program that prevents spam or viruses to harm the device, then the installation process may be interrupted. Its abortion depends on whether the hardware-assistent virtualization is activated or not. This means that with the use of hardware, a platform can be virtualized by hiding physical characteristics and showing another abstract computing platform (Wikipedia 2015*b*). It is also known as hardware virtual machine

(HVM). The antivirus software Avast (Avast 2015) has some problems with an activated hardware-assisted virtualization and aborts an installation if a conflict arises. An example error message is: "This computer meets requirements for HAXM, but VT-x is not turned on...". Therefore, the solution is to uncheck the attribute 'Enable hardware-assisted virtualization' that is displayed in the picture A.1.

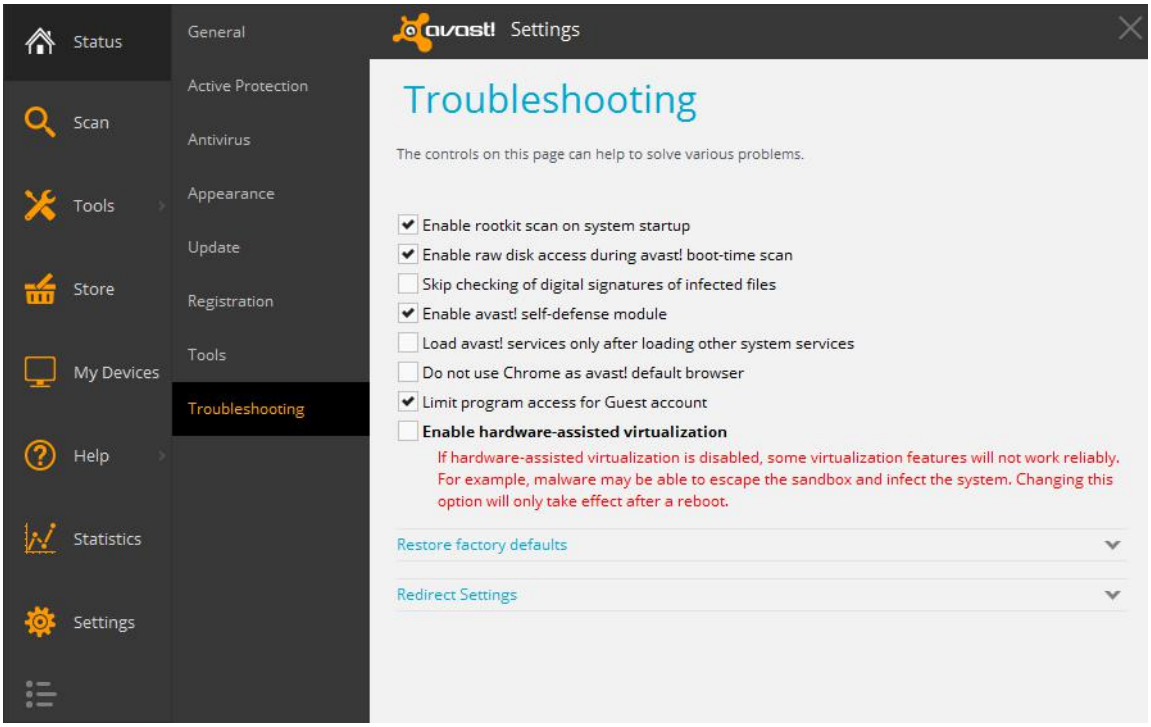


Figure A.1.: The function 'Enable hardware-assistent virtualization' in the Avast settings.

The next images A.2 A.3 A.4 A.5 A.6 will display the installation process in detail. It is important to change the setting in the advanced options on the image from 'Package server' to 'SDK image'.

Figure A.2.: Tizen SDK Installation. The 'Advanced' button must be activated.

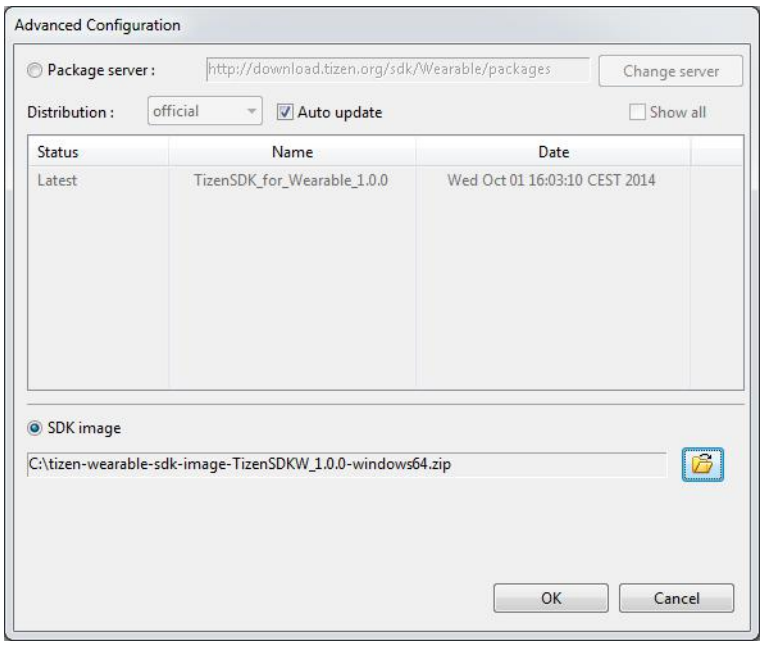


Figure A.3.: The location to the folder of the image must be entered.

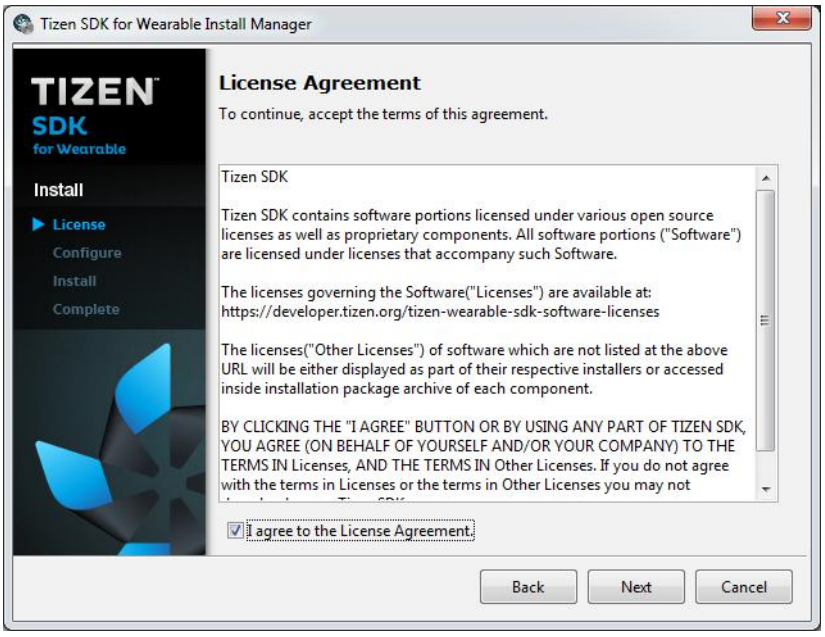


Figure A.4.: Tizen License Agreement acception.

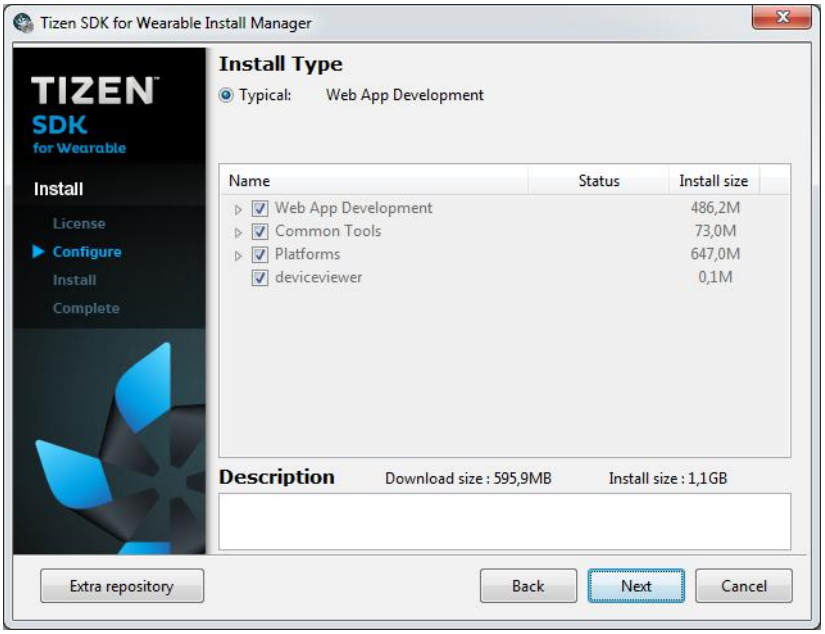


Figure A.5.: Install type is Web App Development.

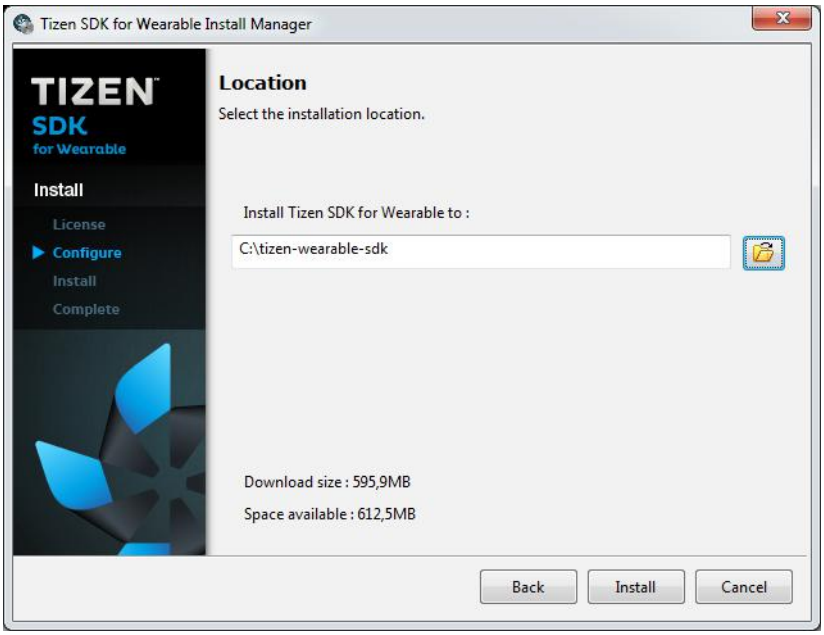


Figure A.6.: Path to storage location must be specified.

A.2. Eclipse and Android Development Tools Installation

The development of the sample and the host-side application will be in Java. Eclipse is an IDE (integrated development environment) that enables developers to generate software and the tool has various plugins to extend its functionality. Therefore, a specific plugin for Android applications exist. It is called ADT (Android Development Tools) and enables the developer to create and execute Android projects (Wikipedia 2015*a*). In this project, a specific Eclipse package is used that contains the necessary features like Eclipse Java Development Tools and it works very well in combination with the Gear application. It is downloadable from the main website of Eclipse for the different system types (Eclipse 2015).

Once the tool is downloaded and installed, various features must be installed with the tool SDK Manager from Eclipse. The most important plugin is the ADT to enable the developer to create Android applications. It is important that Eclipse is already installed before the plugin is added. The following requirements must be given to install ADT successfully:

- Eclipse 3.7.2 (Name: Indigo) or greater
- Eclipse JDT (Java Development Tools) plugin

- JDK 6

Eclipse 3.6 (Helios) is not supported and the JDT plugin, that enables the creation of any Java application and makes Eclipse a development environment, is already implemented in the most Eclipse IDE packages. Additionally, JRE alone is not enough and JDK is needed.

Once the tool is started, the point 'Install New Software' inside the 'Help'-section must be clicked. Afterwards, the 'Add' button must be enabled to define the name of the remote site. In this case „Android Plugin" should be entered. Inside the 'Location' field the URL `\T1\textquotedblleft https://dl-ssl.google.com/android/eclipse/\T1\textquotedblright` is put to generate a reference to the plugin. If an error occurs, it might help to exchange the 'https' with 'http'. After accepting the settings, the „Developer Tools" list entry will appear. Next, the 'Developer Tools' must be marked, because they include the tools 'Android DDMS' and 'Android Development Tools'. These two will be listed in the following dialog and after accepting the license agreement and the installation of any additional (Developer 2015c).

The tool Eclipse will be used to create an Android application for the Samsung Galaxy S4 Mini. In order to connect the mobile phone with the computer, a Samsung USB driver is needed. It contains for example software that enables to synronize files between the two devices and establishes a connection. Androidxda provides a website that contains the Samsung Galaxy USB Drivers for all Samsung models (Androidxda 2015).

A.3. Generate Android Menu and Layout in Eclipse

This program shows the first step of creating an Android application and its components. It generates the menu of the application and the layout. The example also demonstrates how to pass values between components.

```
1
2   @Override
3   //Initialize Activity
4   protected void onCreate(Bundle savedInstanceState) {
5     super.onCreate(savedInstanceState);
6     setContentView(R.layout.activity_main);
7
8     // Reference Views
9     IsConnected = (TextView) findViewById(R.id.tvIsConnected);
10
11
12    // Update connection state
13    if(isConnected()){
14          IsConnected.setBackgroundColor(0xFF00CC00);
15          IsConnected.setText("You are connected");
16    }
17    else{
18          IsConnected.setText("Sorry, you are not connected");
19    }
```

```
20
21
22      try {
23              Thread.sleep(1000);
24          } catch (InterruptedException e) {
25              e.printStackTrace();
26          }
27
28      // Call AsynTask to perform network operation on separate threads to get the data faster
29      new HttpAsyncTaskS7PageViews().execute("www3.omniture.com");
30      new HttpAsyncTaskS7CalledPages().execute("www3.omniture.com");
31      new HttpAsyncTaskS7Bounces().execute("www3.omniture.com");
32
33      new HttpAsyncTaskS7PageViewsAlert().execute("www3.omniture.com");
34
35      //An activity contains more fragments that are responsible for the actions of the user interface.
36      //Use of transactions to add or remove fragments. For example, if the surface must change during runtime.
37      if (savedInstanceState == null) {
38              getSupportFragmentManager().beginTransaction().add(R.id.container, new PlaceholderFragment()).commit();
39          }
40  }
41
42  /*
43      * Android: Menu
44      */
45
46      @Override
47      public boolean onCreateOptionsMenu(Menu menu) {
48          // Check if menu exists, then add items.
49          getMenuInflater().inflate(R.menu.main, menu);
50          return true;
51      }
52
53      @Override
54      public boolean onOptionsItemSelected(MenuItem item) {
55          // Action bar has automatic features like the click on the home button.
56          int id = item.getItemId();
57          if (id == R.id.action_about) {
58              //Intent is used to send data between the components of this app.
59              Intent intent = new Intent(this, AboutActivity.class);
60              startActivity(intent);
61              return true;
62          }
63          return super.onOptionsItemSelected(item);
64      }
65
66  /*
67      * Android: Layout
68      */
69
70      public static class PlaceholderFragment extends Fragment implements OnItemClickListener {
71
72          private ListView listView;
73          private ChartSamplesAdapter adapter;
74
75          public PlaceholderFragment() {
76          }
77
78          @Override
79          //Create the main site
80          public View onCreateView(LayoutInflater inflater, ViewGroup container, Bundle savedInstanceState) {
81              View rootView = inflater.inflate(R.layout.fragment_main, container, false);
82              listView = (ListView) rootView.findViewById(android.R.id.list);
83              adapter = new ChartSamplesAdapter(getActivity(), 0, generateSamplesDescriptions());
84              listView.setAdapter(adapter);
85              listView.setOnItemClickListener(this);
86              return rootView;
87          }
88
89          @Override
90          public void onItemClick(AdapterView<?> adapter, View view, int position, long id) {
91              Intent intent;
92
93              switch (position) {
94              case 0:
95                  // One Item is added to the list
96                  // Intent is used to activate another activity: ViewPagerChartsActivitySkill7
97                  intent = new Intent(getActivity(), ViewPagerChartsActivitySkill7.class);
```

```
98                      startActivity(intent);
99                      // Other intents are used to transfer data to the next activity: key and value are needed
100                 intents7pageViews = new Intent(getActivity(),ViewPagerChartsActivitySkill7.class );
101                 intents7pageViews.putExtra("s7pageViews", jsonStringPageViews.toString());
102                 intents7pageViews.putExtra("s7calledpages", jsonStringCalledPages.toString());
103                 intents7pageViews.putExtra("s7bounces", jsonStringBounces.toString());
104                 Log.i("Intent Saved", "Intent Saved");
105                     startActivity(intents7pageViews);
106                     break;
107                 default:
108                     break;
109                 }
110         }
111
112         //Creates the list with the little image on the right side
113         private List<ChartSampleDescription> generateSamplesDescriptions() {
114             List<ChartSampleDescription> list = new ArrayList<MainActivity.ChartSampleDescription>();
115             list.add(new ChartSampleDescription("Website1","", ChartType.OTHER));
116             return list;
117         }
118     }
119
120     public static class ChartSamplesAdapter extends ArrayAdapter<ChartSampleDescription> {
121
122         //Prepare charts and lists
123         public ChartSamplesAdapter(Context context, int resource, List<ChartSampleDescription> objects) {
124             super(context, resource, objects);
125         }
126
127         @Override
128         //View lowest layer and contains the several components of the user interface.
129         public View getView(int position, View convertView, ViewGroup parent) {
130             ViewHolder holder;
131
132             if (convertView == null) {
133                 convertView = View.inflate(getContext(), R.layout.list_item_sample, null);
134
135                 //Use ViewHolder to store more items.
136                 holder = new ViewHolder();
137                 holder.text1 = (TextView) convertView.findViewById(R.id.text1);
138                 holder.text2 = (TextView) convertView.findViewById(R.id.text2);
139                 holder.chartLayout = (FrameLayout) convertView.findViewById(R.id.chart_layout);
140
141                 convertView.setTag(holder);
142             } else {
143                 holder = (ViewHolder) convertView.getTag();
144             }
145
146             //Set the chart settings of HelloCharts
147             ChartSampleDescription item = getItem(position);
148
149             holder.chartLayout.setVisibility(View.VISIBLE);
150             holder.chartLayout.removeAllViews();
151             AbstractChartView chart;
152             switch (item.chartType) {
153             case OTHER:
154                 chart = new LineChartView(getContext());
155                 holder.chartLayout.addView(chart);
156                 break;
157             default:
158                 chart = null;
159                 holder.chartLayout.setVisibility(View.GONE);
160                 break;
161             }
162
163             if (null != chart) {
164                 chart.setInteractive(false);// Disable touch handling for chart on the ListView.
165             }
166             holder.text1.setText(item.text1);
167             holder.text2.setText(item.text2);
168
169             return convertView;
170         }
171
172         private class ViewHolder {
173
174             TextView text1;
175             TextView text2;
```

```
176                 FrameLayout chartLayout;
177             }
178
179         }
180         //Prepare description of the chart
181         public static class ChartSampleDescription {
182             String text1;
183             String text2;
184             ChartType chartType;
185
186             public ChartSampleDescription(String text1, String text2, ChartType chartType) {
187                 this.text1 = text1;
188                 this.text2 = text2;
189                 this.chartType = chartType;
190             }
191         }
192
193         public enum ChartType {
194             LINE_CHART, COLUMN_CHART, OTHER
195         }
```

A.4. Make a Request using the REST Protocol in Eclipse

This example demonstrates how to use Web services to access an external application with the REST protocol. In this program, the page views from the Anomaly Detection report from Adobe SiteCatalyst are requested and are re-utilised.

```
1   /*
2   * REST: Requests  S7 Page Views
3   */
4
5   public static String GETS7PageViews(String url){
6     String result = "";
7   try {
8
9       // Create the string that includes the necessary data with StringBuilder
10      StringBuilder data = new StringBuilder();
11      data.append("&client_id=" + applicationIDStr); //Use the client id from the Adobe SiteCatalyst Account
12      data.append("&client_secret=" + clientSecretStr); //Use the client secret from the Adobe SiteCatalyst Account
13      data.append("&grant_type=" + grantTypeStr);
14      URL url2 = new URL(url2Str);
15
16      //Establish connection
17      HttpsURLConnection con = (HttpsURLConnection) url2.openConnection();
18      //Add request header
19      con.setRequestMethod("POST");
20      //Send post request, not GET
21      con.setDoOutput(true);
22      DataOutputStream wr = new DataOutputStream(con.getOutputStream());
23      wr.writeBytes(data.toString());
24      wr.flush();
25      wr.close();
26
27      //BufferedReader is used to get the input stream data
28      BufferedReader in = new BufferedReader(
29          new InputStreamReader(con.getInputStream()));
30      String inputLine;
31      //Stringbuffer is used to read each line of the response and the result is saved as a string
32              StringBuffer response = new StringBuffer();
33
34              while ((inputLine = in.readLine()) != null) {
35                  response.append(inputLine);
36              }
37
38              //The response includes the access token for the request
39      String token = response.toString();
40
```

```
41      in.close();
42      //With the accesstoken a new data is made
43      String resultREST1 = GETReportIDS7PageViews(token);
44      Thread.sleep(5000);
45      String resultREST2 = "NULL";
46      String strError ="400";
47      String strError2 ="FileNotFound";
48
49      //As long as the result is Null, the request will be sent
50      while (resultREST2 == "NULL" | resultREST2.toLowerCase().contains(strError) |  resultREST2.toLowerCase().contains(strError2) )
51      {
52            Thread.sleep(1000);
53            resultREST2 = GETReportS7PageViews(token, resultREST1);
54      }
55      Log.i("resultREST2", resultREST2);
56
57
58      //result = response.toString();
59           result = resultREST2;
60      } catch (Exception e) {
61            Log.i("MyActivityMain", "Test:" + e.toString());
62      }
63      return result;
64  }
65
66  public static String GETReportIDS7PageViews(String receivedToken){
67      // This report returns an ID of the report that is processed. After it is finished, the report could be requested with this ID
68       String result2 = "";
69      try {
70                  //Create the request
71            JSONObject json = new JSONObject(receivedToken);
72             receivedToken = json.getString("access_token");
73             String elementID = "siteSection";
74             String reportsuiteID = "---";
75             String datef = "2014-12-04";
76             String datet = "2014-12-06";
77             String granularity = "day";
78             String metricID = "pageviews";
79             String anomalyDetection = "true";
80             String currentData ="true";
81
82                String urlGetElements = "https://api.omniture.com/admin/1.4/rest/?method=Report.Queue&access_token=" + receivedToken;
83            String json2 = "{" +
84            "\"reportDescription\":{" +
85              "\"reportSuiteID\":\"" + reportsuiteID + "\"," +
86              "\"dateFrom\":\"" + datef + "\"," +
87              "\"dateTo\":\"" + datet + "\"," +
88             "\"anomalyDetection\":\"" + anomalyDetection + "\"," +
89             "\"currentData\":\"" + currentData + "\"," +
90              "\"dateGranularity\":\"" + granularity + "\"," +
91              "\"metrics\":[" +
92                      "{" +
93                        "\"id\":\"" + metricID + "\"" +
94                      "}]," +
95              "\"elements\":[" +
96                      "{" +
97                      "\"id\":\"" + elementID + "\"" +
98                      "}]" +
99               "}" +
100     "}";
101
102
103
104     URL urlElements = new URL(urlGetElements);
105
106           HttpsURLConnection con2 = (HttpsURLConnection) urlElements.openConnection();
107           con2.setDoOutput(true);
108           con2.setRequestMethod("POST");
109           con2.setRequestProperty("Content-Type", "application/json");
110
111         // Send post request
112           OutputStream wr2 = con2.getOutputStream();
113           wr2.write(json2.getBytes());
114           wr2.flush();
115
116           BufferedReader in = new BufferedReader(new InputStreamReader(con2.getInputStream()));
117
118           String inputLine;
```

```
119             StringBuffer response = new StringBuffer();
120
121             while ((inputLine = in.readLine()) != null) {
122                 response.append(inputLine);
123             }
124             in.close();
125
126             result2 = response.toString();
127
128         } catch (Exception e) {
129          Log.i("REST Report Call 1", "Test:" + e.toString());
130         }
131             return result2;
132
133 }
134
135     public static String GETReportS7PageViews(String receivedTokenJSON, String reportIDJSON){
136       //It is responsible to use the report ID to get the report data from Adobe Analytics
137       String result2 = "";
138      try {
139             JSONObject json = new JSONObject(receivedTokenJSON);
140             String receivedToken = json.getString("access_token");
141             JSONObject jsonReportID = new JSONObject(reportIDJSON);
142             String reportID = jsonReportID.getString("reportID");
143             Log.i("MyActivity", "reportID:" + reportID);
144
145             String urlGetElements = "https://api.omniture.com/admin/1.4/rest/?method=Report.Get&access_token=" + receivedToken;
146             String json2  = "{" +
147             "\"reportID\":\"" + reportID + "\"" +
148             "}";
149
150             URL urlElements = new URL(urlGetElements);
151
152             HttpsURLConnection con2 = (HttpsURLConnection) urlElements.openConnection();
153             con2.setDoOutput(true);
154             con2.setRequestMethod("POST");
155             con2.setRequestProperty("Content-Type", "application/json");
156
157             // Send post request
158                 OutputStream wr2 = con2.getOutputStream();
159                 wr2.write(json2.getBytes());
160                 wr2.flush();
161
162                     BufferedReader in = new BufferedReader(
163                         new InputStreamReader(con2.getInputStream()));
164
165                     String inputLine;
166                     StringBuffer response = new StringBuffer();
167
168                     while ((inputLine = in.readLine()) != null) {
169                         response.append(inputLine);
170                     }
171                     in.close();
172                     //print result
173                         Log.i("REST Report Call 2", "ResponseCode:" + con2.getResponseCode());
174                     result2 = response.toString();
175
176                 } catch (Exception e) {
177                     Log.i("REST Report Call 2", "Error" + e.toString());
178                     result2 = e.toString();
179                         }
180                     return result2;
181                 }
```