A SHORT ANALYSIS OF THE OF THE SMARTPHONES RELIABILITY

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Abstract *A short analysis of some new results in the area of the reliability for smart mobile phones, the most used electronic devices, is of personal interest for every modern person. The strong competition induced by the globalization imposed necessary developments of the quality and reliability, fixed by ISO 9001-2015. The necessary huge availability of the mobile devices renders necessary new hardware and software efforts for reliability, especially for the first two competitors, Android and iOS. The paper presents mainly a short overview of a few recent statistical results, especially for the failure rates, and a comparison with older values (2011). An important growth of the reliability and availability is easy to detect, associated with the big efforts of the producers in testing these devices and huge development of applications.*

K**ey words***: reliability, smartphones, software*

1. Introduction

The mobile phones, the most used electronic devices in the present, have a great impact on communications and business, making more accessible and rapid manipulation of data.
An up-to-date study of the market share of global smartphone Operating Systems shipments by mobile operating system per quarter from STATISTA [7] shows the big predominance of Android, an open source operating system released by the mighty Google. In all the quarters of the year 2016 (fig.1) [7] it is obvious the majority of Android apps(around 80%), the existence of iOS (around 17%)and a few Windows (rest) or other OS. Table 1 presents the comparative evolution of smatphones sales in 2016 and 2015, with practically the same results [8]. This usage level shows even a degree of reliability of smartphone OS. One of the greatest features of the Android OS is the wide range of apps applications found in its marketplace, now known as the Google Play Store: with the open source philosophy (which is amazing) almost anyone had the opportunity to create an app for the Android Play Store.

Operating System	4Q16 Units [thousands]	4Q16 Market Share[%]	4Q15 Units [thousands]	4Q15 Market Share[%]
Android	352670	81.7	3253944	80.7
iOS	77039	17.9	71.526	17.7
Windows	1092	0.3	4395	1.1
BlackBerry	208	0.0	907	0.25
Other OS	530	0.1	887	0.25
Total	431539	100	403109	100

Tab. 1 *The comparative evolution of smatphones sales in 2016 and 2015 [8]*

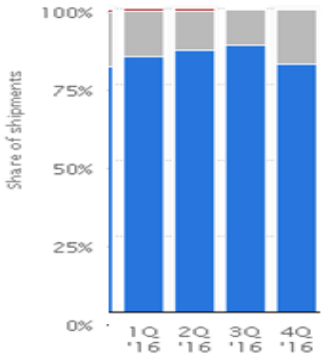

Fig.1 *Market sharee 2016 [7]*

2. Smartphone reliability problems

The strong impact of the smartphones reliability was pointed out in the last time with the model Samsung Galaxy Note 7, with "a manufacturing defect in the corner of the batteries.
A design flaw made the electrodes prone to bending. This could lead to a separation and short-circuit in the battery itself, and was responsible for some of the fires" [2]. A welding defect and a lack of insulation tape could lead to problems with the batteries [2].

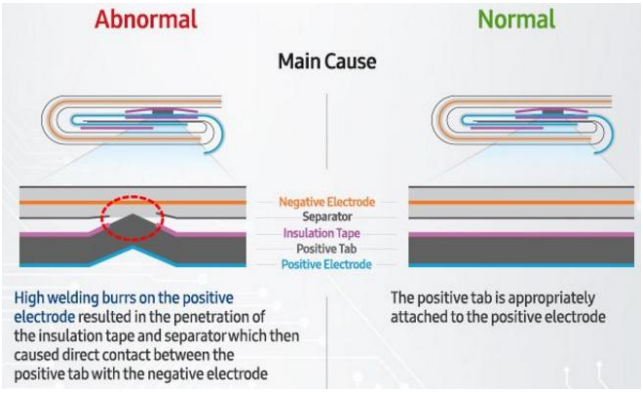

Fig. 2 *Samsung Galaxy Note 7model reliability problems[2]*

Except for this case, the lack or poorness of published smartphone failure data for secrecy reasons renders difficult any evaluation of their reliability.
An early study (2010) of SquareTrade [11] compared the failure rates of iPhone, Blackberry, and the 2 major Android phone manufacturers (Motorola and HTC), as well as an aggregated pool of all other smart phones. The customer reported failure data were analyzed from a sample of over 50,000 new mobile phones (Fig.3)[11]. Additionally Square Trade compared the malfunction rates for different data processing digital devices (Fig.4) [11].

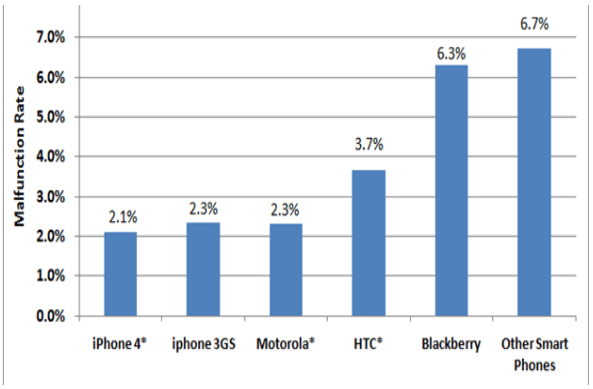

Fig.3 *Reported malfunction rate after 12 months of smartphone use*

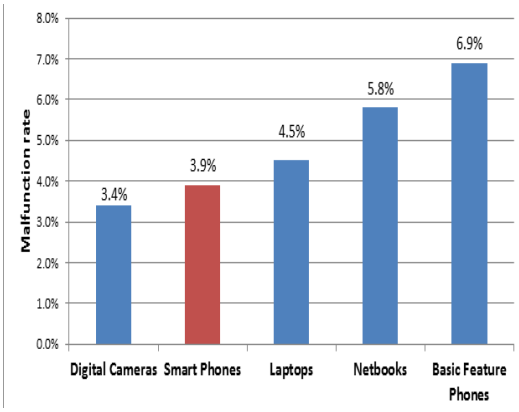

Fig.4 *Reported malfunction rate after 12 months of smartphone use*

The smartphone's important reliability achievements in the reliability is obvious (fig.4): they are the newest devices in the data processing category (2010!) and these phones are among the most reliable electronic products.

3. Some evaluations on smartphones reliability

An overlook on the newest statistics on the smartphone reliability prove that the few published information are changing in a short time: In May 2016 Dominik Bosnjak stated in the Study „Android Smartphone Failure Rate Higher Than iOS" [10] , citing the research and analytics company Blancco Technology Group, that "Android devices are significantly more unreliable than their Apple-made counterparts, with a failure rate of 44% against only 25% break down for iOS during their usage cycle"[10].

Just after one quarter, in a new report of the same company [9],"Apple has lost its usual 'leader' position to Android in the eternal smartphone performance battle. Plagued by crashing apps, WiFi connectivity and other performance issues, the iOS failure rate more than doubled to 58 percent in the second quarter of 2016, compared to its 25 percent failure rate in the previous quarter" [9].

These changes should be explain by the introduction of new models, with insufficient tests, in the run for market share. On the other side the unclear definition of failure rate bounded with operator inexperience makes very difficult a consistent evaluation on reliability. The side of software and applications [4, 5] became more and more important for smartphones reliability. Software reliability, as an important quality attribute, can be defined as "the probability of failure-free software operation for a specified period of time in a specified environment" [6]. The execution sequence of states and individual states determine the reliability of a software system - Software Reliability Engineering (SRE) [6]. The first software reliability growth models (SRGM) was developed in 1972 and SRGMs were initially designed to assess the evolution of software in its successive testing phases [3]. An interesting work was developed by Sonia Meskini in the master thesis "Reliability Models Applied to Smartphone Applications" [2]. She investigated three popular messaging and audio- and video-calling apps (Skype, Vtok for Google and Windows app) and used mainly Weibull and Gamma distributions to model the reliability. The main registrated failure of smartphone applications had as causes: data input, hardware, wireless network, third party software, mobile data bases, OS version or software upgrades [3]. As a personal observation, it should be pointed out the big influence on the reliability of the operator attention and experience with the softwere application, that should explain the wide differences between the values of times to failures, from less than an hour to more then 1000 hours. In table 2 are given the values for the shape factor β of the Weibull reliability distributions of the analysed smartphone types.

Weibull Distribution						
Apps	Skype V1	Skype V2	Skype V3	Vtok V1	Vtok V2	Windows
β factor	b = 2.82	b = 1.45	b = 1.94	b = 2.706	b = 1.79	b = 6.24
MTBF	5.49	5.71	7.74	10.02	5.18	20.46

***Table 2**. Reliability indicators for the analysed applications*

As it is known the Weibull distributions with $\beta > 1$ have a failure rate that increases with time, also known as wear-out failures [1]. Here all the β values are over 1 that means old products [4], what is in my opinion not very clear, considering the novelty of the applications as for example the 3 versions of Skype don't differ significantly.
Further the reduced values for MTBF, in this case a few hours, except partially for Windows, confirm this remark, the wear- out of the software. The wide differences between TBF values (from 1 to 1000) render difficult an accurate interpretation of data.

4. Conclusions

Any analysis of quality and reliability for smart mobile phones, the most used electronic devices, is of interest for every modern person (consumer). To avoid the possible misunderstandings it should be very useful to clearly define the threats that can affect the device and cause a drop in dependability. There are three main terms that must be clearly understood: faults (bugs), error and failure for every consistent analysis. It should be pinpointed the huge sales worldwide, and with lower prices, to consumer categories completely new, with the such advanced processing data devices. The lack of experience of those people can be considered the main source of the problems, mainly on the software side. Anyway the accelerated development of the market gives good perspectives and SRGMs will soon demonstrate this. A final choice for adequate software and hardware quality and reliability of smartphones should consider the customer conditions for experience, data volume and necessary investment.

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