Conceptual Framework for Mobile Device Product Line Security based on Internet of Thing

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Abstract

Numerous technology devices have been propelled to explore the prospects of mobile devices. There is a growing demand to transform the existing PC-based software systems to mobile device platforms since mobile devices are low-cost compared for a PC, and their affordance, usability, and user-friendliness are such that they can theoretically counterpart or even replace traditional computer technology and mobile devices perform well using a lesser amount of memory than PC-based systems. Mobile device product lines are promising approaches for deriving and delivering custom-made applications to devices. In this paper, a conceptual framework for the mobile device product line is designed to create a strategic concept on how the mobile device delivers its application towards its users. It is designed to construct an interaction within the mobile application to its user devices.

Mobile Device Product Line Security is a new concept, which appears with the Internet of Things (IoT) application in industry. This technology applied in production systems provides many benefits like better transparency or real-time information. This approach proposes a conceptual framework for IoT application in Production Systems Security. The aim of this framework is helping enterprises to identify the main elements to apply IoT in Mobile Device Product Line Security Systems.

Keywords: Mobile Device, Product Line Security, IoT

1. Introduction

The place of our "digital" intelligence, i.e., the world of our digital data, knowledge, and functionality, is progressively moving from our desktop PC or laptop to our miniaturized mobile devices - such as smartphones, MP3 players, or PDAs. At the same time, in the physical spaces where we live – shops, museums, archeological sites, airports, fitness centers, town squares, we are progressively surrounded with digital information delivered via large public displays. Current technology enables us to integrate "the small" and "the large", and opens a number of new possibilities for creating innovative, engaging user experiences [2].

A conceptual framework is used in research to outline possible courses of action or to present a preferred approach to an idea or thought. The conceptual framework is one of the common techniques that is used to mobile device product lines. This product line has optional features that concisely expressed using frameworks. A particular framework or framework dimensions is created by a composition of application features and product instances.

Although no universal definition exists for Internet of Things, the core concept is that everyday objects can be equipped with identifying, sensing, networking and processing capabilities, which will allow them to communicate with one another, and with other devices and services, over the Internet to achieve some useful objective (Atzori *et al.,*

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2010). Miorandi *et al.*, (2012) briefly, summarizes the three main system-level characteristics of the Internet-of-Things as follows: Anything communicates, anything is identified and anything interacts.

2. Related Works

In this Section, current practices in the development of mobile device services, product line techniques that may be suitable for the conceptual framework for the mobile device product line.

2.1. Product Line Practice in the Mobile Industry

Commercial J2ME applications for mobile devices are not very abundant because J2ME is a relatively new technology [4] and it has only recently become a standard option deployed with new mobile phones on the market. For example, the J2ME virtual machine does not even come pre-installed with the Palm OS or Microsoft's Pocket PC. In addition, it has taken time for software development kits (SDK's), toolsets and integrated development environments (IDE's) to offer developers support in mobile development. The lack of a standardized platform has led to the industry adopting a number of ad hoc approaches.

The lack of a standardized platform has led to the industry adopting a number of ad hoc approaches. An interview with Allen Lau, CTO of Tira Wireless[8] suggests that a large number of mobile application providers tend to target only the most dominant device platforms, and consider porting to other devices only if the demand is there. Allen further describes the J2ME (game) industry as being divided into application developers and specialized porting companies. In many cases, publishers of original application content develop one or two generic versions of their J2ME application for representative 'mass market' devices (such as the Nokia Series 60 and Series 40 platforms) and then arrange for another company to port, optimize and test the application for all the other handsets it must support. This seems to be a desirable option for small mobile developers who do not have the resources or access to all the hardware to port and test it on their own. In fact, there are a number of companies that have built successful business models around porting J2ME games and business applications across various devices. [9] Unfortunately, there is very little information on the processes these porting companies follow. This indicates a very real problem for programmers or small software companies who want to develop applications for devices in the mobile industry. It is a problem that is likely to get worse before it gets better as the number of phones; PDA's and other microdevices deployed commercially increases over the next two to three years. Some recent open source projects such as Antenna [10], J2ME Polish [11] and NetBeans Mobility [12] offer utilities to help alleviate this problem but tend to help with only specific problems such as UI.

2.2. General Product Line Practices

With the advances in wireless technology and reduced costs of micro hardware, the mobile computer industry has only recently become a popular platform for custom application development. As a result, product line techniques in the mobile space are not well established or implemented. The software development environment for this technology has some significant differences compared to desktop computing which means typical product line approaches are not necessarily effective. Outside the mobile application domain, there are a variety of product line implementation techniques that have been used with different degrees of success. Some are used in isolation; others can be used in combination with different product line approaches or complementary component and framework methodologies. This section presents general product line

practices that could be considered for mobile application development. In the cases where these general techniques have been tried with mobile development, we comment on their applicability to the device API fragmentation problem [5].

2.3. Object-Oriented Frameworks and Patterns

Object-oriented frameworks [6] and design patterns[7] are an effective way of building re-usable components and sometimes form the basis of product line development practices. Some of these object-oriented frameworks have component models integrated into them that allow plug-n-play behavior for software applications with many optional features. This makes it easy to mix and match different applications (with unique features) to form a complete product instance.

2.4. Internet of Things in Mobile Device Product Line

The main characteristic of Mobile Device Product Line Security is the promptness to react in front of disturbances due to detecting events in real time with the help of new technologies, mainly IoT. This is a new concept which allows any object communicates with others objects through Internet, and provide information in real time with new technologies, like RFID and sensors, to facilitate the exchange of goods and services in global supply chain networks (Gu et al.,2014; Tan et Koo, 2014; Wang, 2014; Whitmore et al.,2014).Internet of Things is structured in three levels (Atzori et al., 2010; Bandyopadhyay et Sen, 2011; Gubbi et al., 2013; Gu et al.,2014; Singh, Tripathi et al., 2014).

3. Mobile Device Services

Mobile devices bids convenient and appropriate traditions to map human relations in a global atmosphere and are frequently an essential part of product instances. By means of a mobile device, it is simpler that moving to reach a touch screen nearby. Furthermore, one does not have to stay in line to use a mobile device, as it would be the case with sharing a common device when there are other people in the same place. Using mobile devices for interaction also does not conflict with using other forms of communication, e.g., voice and gestures, but can be used to enhance them. Mobile phones were the first mobile devices to have global success and wide acceptance. Based on this success, there is a trend to enrich the number of services that are offered to people via mobile phones, benefiting from an extensive existing user base.
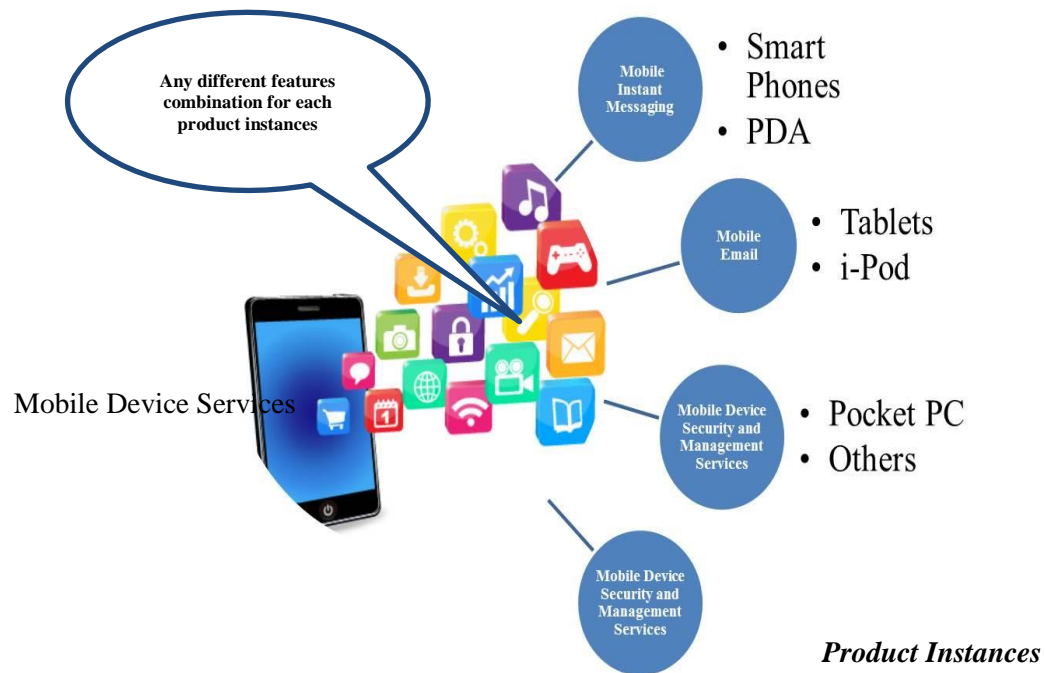
Figure 1. Overview of Mobile Device Product Line

4. Mobile Device Software

Mobile devices and their services play a significant and mounting part in a global world of computing. Software infrastructure that construct and establish application functionality, the unified passage of reasoning among mobile devices and another environment, mobile devices software modeling, and scalability of the results should transpire in order to create a quality of software infrastructure for a mobile device.
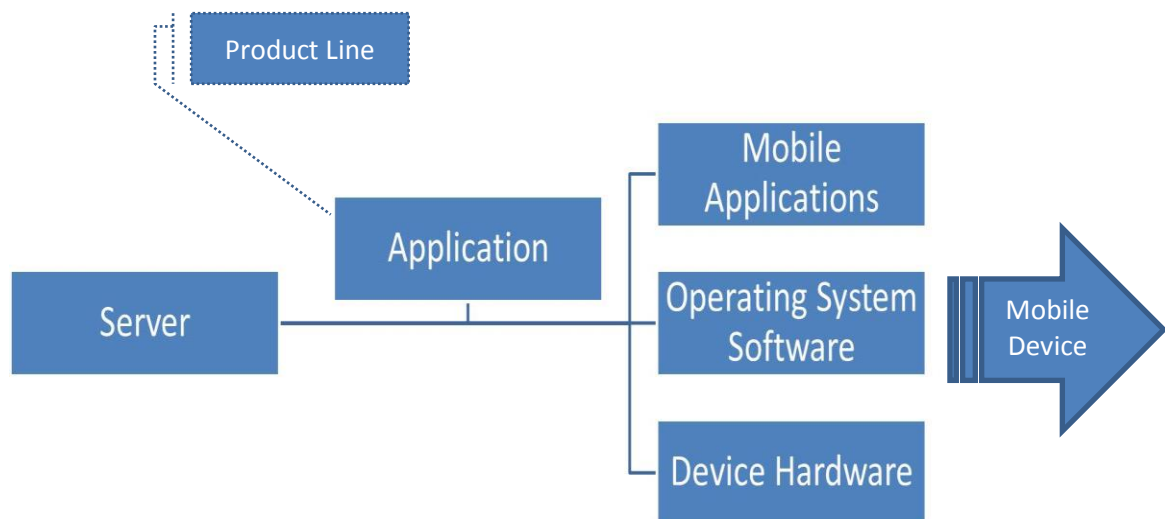

Figure 2. Mobile Device Software Infrastructure

Figure 2 shows the mobile device software infrastructure that supports the distribution of applications to each mobile device. This infrastructure is important for communication and collaboration features of mobile technologies that had been stressed in the framework of the mobile device. This software product line is a set of software-intensive systems sharing a common, managed set of features developed from a common set application.

5. Conceptual Framework for Mobile Device Security

Mobile device usage undertakes and enterprise application delivery requires always-on connectivity. To take full advantage of the mobile devices, they must be able to connect reliably and deliver a comparable experience to the wired network. This fact will only increase as mission-critical enterprise computing becomes more available on mobile platforms.
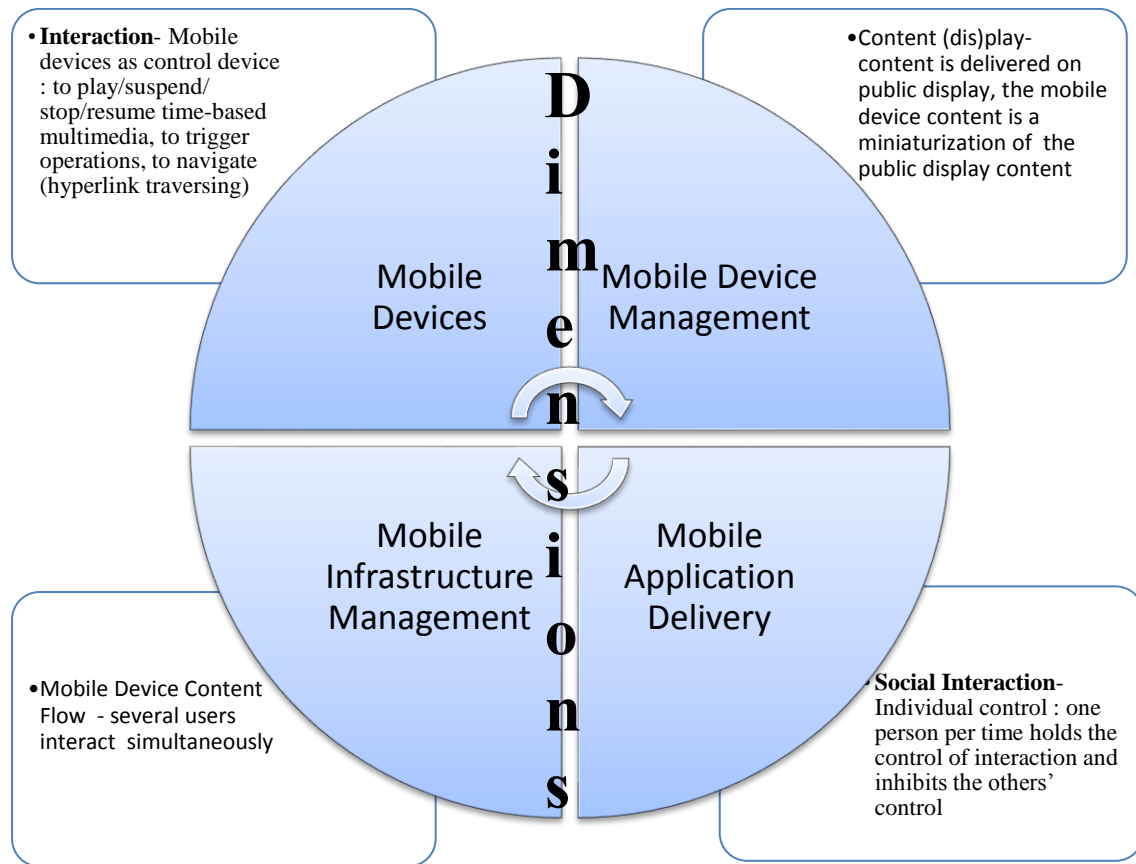

- **Interaction**- Mobile devices as control device : to play/suspend/ stop/resume time-based multimedia, to trigger operations, to navigate (hyperlink traversing)

- Content (dis)play- content is delivered on public display, the mobile device content is a miniaturization of the public display content

- Mobile Device Content Flow - several users interact simultaneously

Social Interaction- Individual control : one person per time holds the control of interaction and inhibits the others' control

Dimensions

Mobile Devices

Mobile Device Management

Mobile Infrastructure Management

Mobile Application Delivery

Figure 3. Conceptual Framework for Mobile Device

Mobile devices, such as smartphones, mobile internet devices and web-enabled media players, are becoming widespread. These devices possess limited resources, which motivates resource optimizations. Mobile devices are hawking the marketplace over their stationary counterparts. This involves Interaction- where mobile devices as control device either to play/suspend/ stop/resume time-based multimedia or to trigger operations, to navigate (hyperlink traversing).

6. IoT Application Concepts in Mobile Device Product Line

To sum up, Sensing Enterprises are based on Internet of Things, and IoT is structured in three levels: Edge, the physical part (RFID, sensor, etc); Access, the part carried out of

object communication; and Application, which can be new application or a module to extend the present information system (Figure 4).

Based on these concepts, enterprise has to contemplate the phase whose information must be improved (Inventory to plan, product localization to operate, production environment to control, etc). Then, enterprise should study the elements necessary for each level of IoT structure:
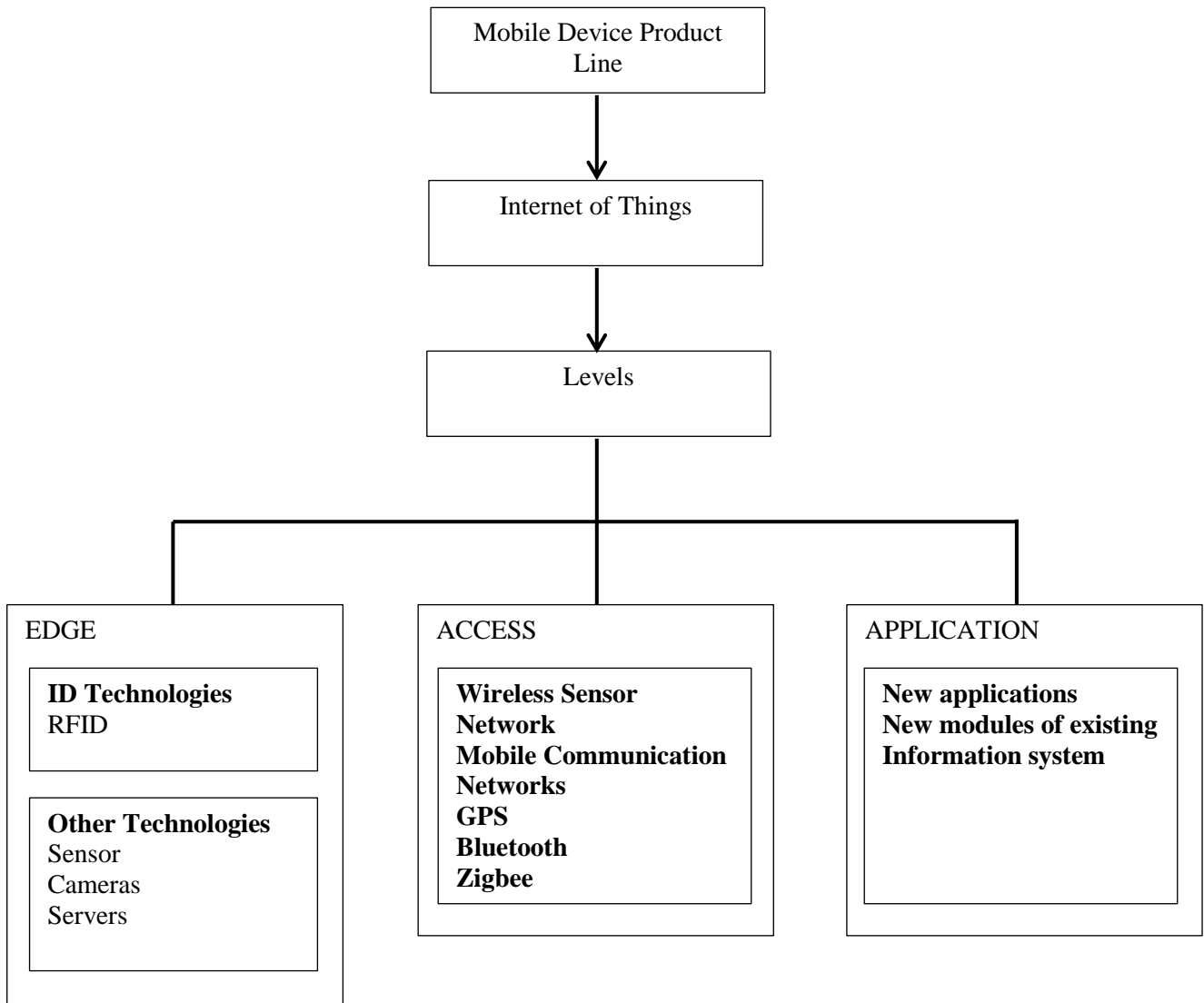
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          │  Mobile Device Product  │
          │          Line           │
          └────────────┬────────────┘
                       │
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          │    Internet of Things   │
          └────────────┬────────────┘
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          │          Levels         │
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EDGE

> **ID Technologies**
> RFID

> **Other Technologies**
> Sensor
> Cameras
> Servers

ACCESS

> **Wireless Sensor Network**
> **Mobile Communication Networks**
> **GPS**
> **Bluetooth**
> **Zigbee**

APPLICATION

> **New applications**
> **New modules of existing Information system**

Figure 4. Main Concepts of IoT Application

A conceptual framework for Internet of Things Application in Production System of Sensing Enterprises is presented. Figure 3 represents the complete framework joining the concepts presented before. Mobile Device Production Line has a production system that is improved with Information Systems. Information Systems are complemented by product information provided by IoT, which is structured in three levels: Edge, Access, and Application.

In summary, IoT provides value information, taken from production system or other systems with relevant information for production, which enriches the Enterprise Information Systems. This information system based on IoT improves the different phases of Production System: Planning, Operations and Control (Figure 5).
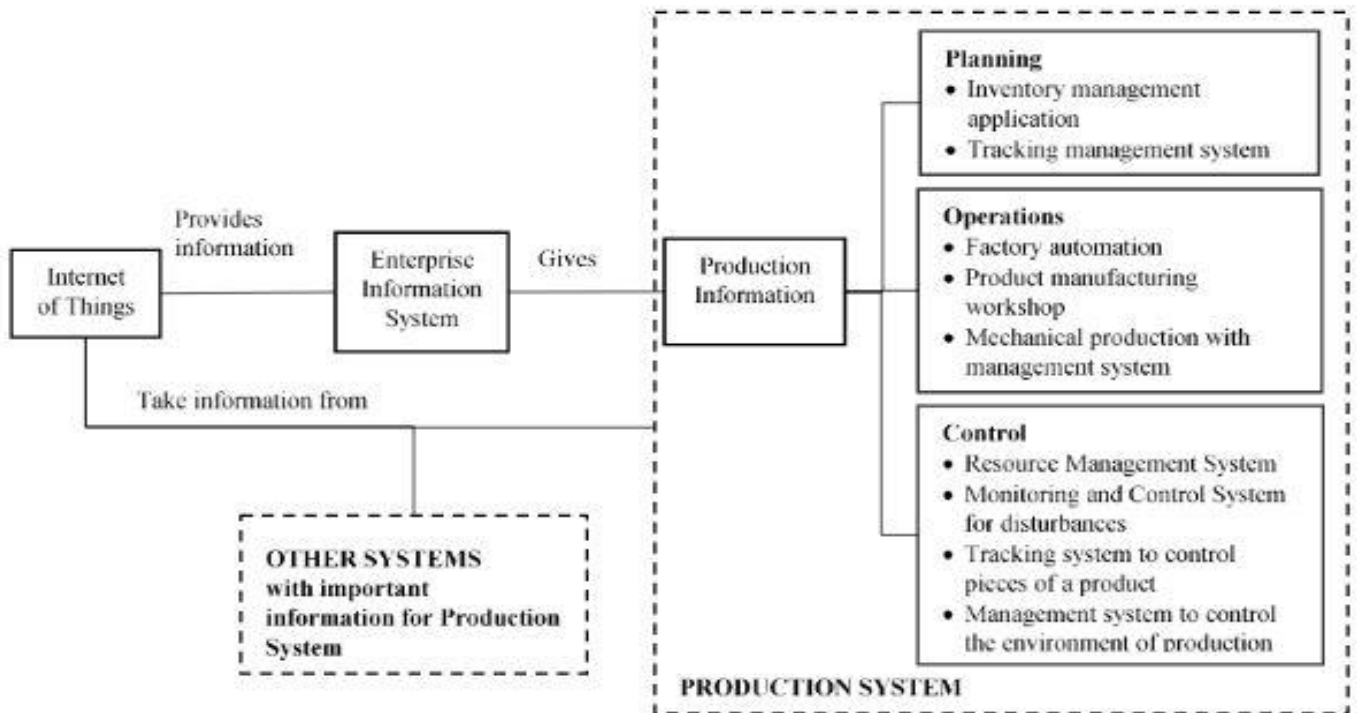
Figure 5. Main Concepts of IoT in Production System

6. Conclusion

The rapid development of the mobile device and its application brings an unmeasurable impact in the technology world. Therefore this conceptual framework for mobile device product line supports and improves the existing communication between mobile applications and mobile device users. It will able to obtain custom systems running on various mobile devices from customization of a common base of adaptable and reusable components, rather than implementing another framework. This paper presents a conceptual framework about IoT in Production system inside Sensing Enterprise. To define this framework, a literature review about IoT applications in production System has been made. Even though there are few types of research, main concepts of IoT applied in Production System has been extracted.

Acknowledgment

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