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Position Paper

Semi-network OS and Embedded OS for Co-mobile Computing

Yin Sheng Zhang
University of British Columbia, Canada
cxo888@hotmail.com, walterz862@hotmail.com

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Abstract

Purpose – This research aims to supplement or replace the existing embedded OS with architecture of semi-network OS, so as to form a co-mobile computing system and to create a new type of networked mobile devices.

Method – Co-mobile computing system can only be realized by combining network resources with local resources, then this combination of resources is used to promote intelligent mobile devices to integrate into modern network environment more quickly and comprehensively, and then intelligent mobile devices become real networked one.

Result – Under co-mobile computing system, networked mobile devices can not only safely use local resources to maintain the stability and reliability of devices operation, which is mainly attributed to the base portion of semi-network OS (similar to existing embedded OS), but also make full use of network resources to remedy the defect of existing embedded OS, which is mainly attributed to the expanded portion of semi-network OS.

Conclusion – The concept of co-mobile computing mentioned here is defined as a data computing system specially designed for networked mobile devices, which is based on semi-network resources and formed by the merging of multiple networked mobile

devices with different embedded OS and functions, now, the semi-network OS architecture will pave a new way for advancement of co-mobile computing system. The semi-network OS refers to that a complete operating system is divided into an expanded portion and a base portion, where the expanded portion of OS is stored on network server, which is ready to be downloaded at any time (similar to a supplement to embedded OS), and the base portion of OS is stored in OSPU located on local platform (similar to embedded OS); wherein the OSPU is a key hardware component in semi-network OS architecture and is movably installed on different local platforms by users.

Keywords-base portion of semi-network OS, expanded portion of semi-network OS, embedded OS, co-mobile computing, OSPU, semi-network OS

INTRODUCTION

This research aims to supplement or replace the existing embedded OS with architecture of semi-network OS, so as to form a co-mobile computing system and to create a new type of networked mobile devices.

The main defect of existing embedded OS is its single-task and non-scalability attributes, which hinders function expansion of intelligent mobile devices, and is not conducive to the integration of intelligent mobile devices with the latest technologies and the latest user needs in some respect, so it is necessary to explore better solutions.

Co-mobile computing system can only be realized by combining network resources with local resources, then this combination of resources is used to promote intelligent mobile devices to integrate into modern network environment more quickly and comprehensively, and then intelligent mobile devices become real networked one.

Under co-mobile computing system, networked mobile devices can not only safely use local resources to maintain the stability and reliability of devices operation, which is mainly attributed to the base portion of semi-network OS (similar to existing embedded OS), but also make full use of network resources to remedy the defect of existing embedded OS, which is mainly attributed to the expanded portion of semi-network OS.

Since the emergence of smart phones, even though the concept of networked mobile device has been very widely accepted by academia and business field, but the emergence of multi-tasks networked mobile devices are not as exciting as people think, most people still just link the concept of intelligent computing together with smart phone or similar, and it is still a dream for people that multiple similar networked mobile devices are combined into one under the concept of co-mobile computing and form a tide of consumption, and one of the key constraints to the improvement of situation is the limitation of existing architecture of embedded OS.

The concept of co-mobile computing mentioned here is defined as a data computing system specially designed for networked mobile devices, which is based on semi-network resources and formed by the merging of multiple networked mobile devices with different embedded OS and functions.

Now, semi-network OS architecture will be used as an alternative solution to replace or supplement existing embedded OS architecture here, and which may pave a new way for advancement of co-mobile computing system.

The semi-network OS refers to that a complete operating system is divided into an expanded portion and a base portion, the base portion of OS is stored in OSPU located on local platform (similar to existing embedded OS), and the vast majority of system files (expanded portion) of OS in semi-network OS architecture is stored on network server, which is ready to be downloaded at any time (similar to a supplement to embedded OS).

The network server in semi-network OS architecture is only a storage site of system files rather than operating site of OS, and those system files stored there cannot be a standalone operating system, and they can only be downloaded to local platform, reprocessed by OSPU, and combined with some other system files of full OS (base portion) to form a completed system then to perform their computing tasks; wherein the base portion of semi-network OS is stored in OSPU.

OSPU (the abbreviation of "operating system processing unit") is constituted with a set of non-volatile ROM chip located on local platform, which is the most important supporting hardware for semi-network OS architecture, such as acting as a hardware component for guiding expanded portion of semi-network OS to be downloaded to specific local platform, and it will provide storage site for the base portion of semi-network OS.

The base portion of semi-network OS is "similar" rather than "identical" to the existing embedded OS, that is because they run under different system architectures, and the existing embedded OS has no "expanded portion" of OS to combine like semi-network OS architecture.

Therefore, the so-called "supplement" in relationship between semi-network OS and existing embedded OS is just to insert an OSPU into a device that installed existing embedded OS, and then the semi-network OS acts as the backup system of the device.

EXISTING EMBEDDED OS ARCHITECTURE

Nearly all the existing embedded OS in networked mobile device is only a single-task one, and the operating system lacks scalability, which is not easy to meet the function diversification requirement.

In order to combine two or more of networked mobile devices into one, the first problem to face is operating system, we know that networked mobile device is a combination of software and hardware that suitable for connecting to network via wired or wireless network, its main components include the embedded OS, the specific application, the embedded processor, memory, communication module, sensor, and peripheral hardware device; where the status of the embedded OS is crucial, because it supports and manage all other components.

To combine multiple networked mobile devices into one, while also need to combine a variety of different components and embedded operating systems into one, in this case, some components can be shared by networked mobile device , such as above-mentioned four major components and some software application existed in different devices, since they are coded to perform the same task before combination, as long as extracting these common portion and try to rebuild a relatively independent basic portion of OS, and embed this basic portion of OS into certain chip of networked mobile device, then the most basic systems support of device operation can be guaranteed.

On other hand, the purpose of co-mobile computing is not just to share relevant function and task of original devices, in fact, some parts of original device surely cannot be shared after combination.

Further, with the current innovation of networked mobile devices, the new features will flood into system for the foreseeable future, and these new features need to be achieved by adding more applications, which also makes the content of OS increasing and changing constantly, if all the contents of systems and applications are installed in chip of device, the OS of networked mobile device will be forced to embark on the path of forever expansion, or all of the application and OS are embedded in a enclosed chip, but that means to reject further and better improvement of device.

NOVELTY OF SEMI-NETWORK OS ARCHITECTURE

A. The biggest difference.

The system files are divided into two parts in semi-network OS architecture, one of them is called the base portion of OS being embedded in OSPU chip on local platform, which is similar to existing embedded OS, but OSPU has semi-mobile attribute, so it is different from the hardware carrier of existing embedded OS, and another part of system files is called expanded portion of OS being stored on network server, which is completely absent in existing architecture of embedded OS; moreover, under the semi-network OS architecture, the RAM of local computing device will replace the hard disk as a temporary storage and operation site of the expanded portion of OS downloaded from network server, this situation does not exist under existing architecture of embedded OS either, and thus the semi-network OS architecture has obvious novelty compared with the existing architecture of embedded OS.

The concept of "semi-mobile" attribute of OSPU mentioned above refers to that OSPU as a portable hardware component in semi-network OS architecture can be removed from one device then installed into another device at any time, in this case, the transfer of one hardware component will drive the transfer of overall operating system with user's personalized settings without the need for whole device to "move" as in the existing mode, so which is different from the existing concept of "mobile".

B. Innovation.

Now all networked mobile devices are using the architecture of existing embedded OS, it is obvious that the existing embedded OS architecture is much safer than the other traditional architecture that OS being freely installed on the hard disk of local computing devices, but the weak points of existing architecture of embedded OS are also obvious that its content is lack of scalability and its operation lack of flexibility, these weak points may not constitute a big problem for general networked mobile devices that are single function and dedicated to a single task, and in today's networked mobile device configuration mode, which is also the only and best option available.

However, if users want to transform a networked mobile device with single feature into one with complex features, device's function and task will change from simplification to diversification, which requires breaking original idea to find a new system model with strong flexibility, that is, to form a co-mobile computing system, in this case, semi-network OS is exactly in line with the new requirements for co-mobile computing, and also it can overcome above-mentioned weak points of embedded OS due to its most important feature of the flexibility.

According to the concept of semi-network OS, the system files of a complete OS that running on local platform mainly contains two parts, the main part of which is stored on a network server and to be downloaded to local platform as needed, this part determines the flexibility of OS, while another part of system files will be embedded in a chipset of OSPU, which is permanently placed on local platform to insure the stability of device operation.

The two parts of system files must be loaded into RAM of local platform and to be combined into a complete OS to fully play its role, therefore, compared with the embedded OS used by networked mobile devices currently, the semi-network OS not only has stability and security like common embedded OS, but also has flexibility of operation and functionality that common embedded OS do not have.

C. Performance.

There is a part of system files to be embedded in a chipset (OSPU) in semi-network OS architecture to independently support the operations of major hardware on local

platform, especially, it maintains the basic operation capability of devices even when network is disconnected, so this feature can also be used to enhance performance of networked mobile device.

The functions of mobile device become diversified in co-mobile computing system, although therein many functions are running in one device, but these functions will only need one set of architecture of basic hardware as a tool, such as CPU, RAM, motherboards, power supplies, etc, therefore, in most cases, while a networked mobile device is increased in its functionality, the content of its system files embedded in OSPU (base portion of OS) does not need to be increased, and the additional demand of system files caused by increasing functions will be supplemented by system files (expanded portion of OS) of semi-network OS downloaded from network server, and which creates the scaling flexibility of device.

The base portion of semi-network OS is different from the embedded OS that is used in general networked mobile device currently, and the most obvious difference between them is that the base portion of semi-network OS is not configured for a single task in device, and it supports major hardware and software of local platform that carry a wide variety of functions.

In addition, the base portion of semi-network OS requires to be combined with system files from network source, and the system files from both of network and local platform have to be integrated into a complete semi-network OS then can run well, otherwise the base portion of semi-network OS can only support the running of basic hardware and application software.

CHALLENGES

When existing system model of computer appeared, modern network technology has not yet appeared, so its initial architecture cannot take into account the requirements of network conditions, of course, also not to take into account the technical requirements of co-mobile computing.

When rising of concept of modern network technology and co-mobile computing, existing system model has occupied almost all the IT consumer market, and IT industry giants have been unbearable at expense of market lost to make fundamental change for existing system model, so it become a challenge of promotion of concept of co-mobile computing.

A. Capacity and function.

The most embedded OS of existing model are permanently installed and one-to-one bundled on specific device, which does not leave any room for other application software

to install on the same memory chip or hard disk, and makes it impossible to diversify the tasks of device, but in order to adapt to the changes of network environment and cope with the attacks of viruses and hackers, the embedded OS architecture has to allow software application to be continually increased in device for security purposes, so the only way is to bundle a large number of applications together with embedded OS in a closed carrier, as a result, the content of embedded OS become more and more expanded and complicated, and can only reduce the device's functions to make device smaller, or only restrict device's network activity to ensure data security, which results in device's capacity and function to be miniaturized.

B. Cost of production and operation.

The most embedded OS of existing model have nothing to do with network, whether network connected or not, they do not change the function, more not the networking to be the premise of devices to functioning, therefore, it requires a series of additional technical measures, mainly adding application software, as a supplement to make the networked mobile device that installed embedded OS into a kind of devices that take network as a center, and make the networked mobile device to accept the control of network, but which will make device's cost of production and operation increased.

C. Open installation site.

The existing embedded OS is usual installed on single-task networked mobile devices, so it does not need to be provided a dedicated open installation site on local platform for network download data and other application software, but now, with the trends of that mobile computing devices use network resources to expand their capabilities, it will become normal that another installation site on local platform is required for data network downloading and for application software to be freely installed, in this case, a variety of illegal software will also take advantage of this chance (or weakness) to install their own programs on local platform, and the user data generated from local platform will be always the main objective of viruses, hacker and phishing to attack, which may make system failure frequently, and makes user lose confidence in networked mobile device.

D. Self-forming system.

Local platform and network server of existing model are separated from each other and self-forming each own system, for example, most local platform's data security mechanisms are designed fully for needs of local platform, and directly to be deployed on local platform, which rarely take into account the correlation with server, so the local platform is often unconsciously become the base for illegal software attacks server, and server end also has the same situation, then self-forming system at both ends of network will surely to be disadvantages of innovation of co-mobile computing.

In addition, the problems faced by co-mobile computing also include system testing for data downloading from server to local platform or uploading from local platform to server, this system testing process rarely hooks with device hardware information under the existing architecture of embedded OS, more rarely the user's personal login information and passwords to be replaced by device hardware information as main credential for network access.

User's personal login information and passwords belonging to software information that easy to be leaked and maliciously modified by people, then in the case of co-mobile computing system being built around network, it is clearly not enough to only take software information as user authentication credentials.

CONCLUSION

The semi-network OS architecture and related OSPU try to increase mobility and security of networked mobile device, and pushes forward the co-mobile computing to take a new step in innovation of existing embedded OS.

OSPU is a key component in semi-network OS architecture and it is also significant for improvement of networked mobile device and embedded OS, which especially reflected in the following points:

A.The semi-network OS architecture provides the most direct network connection and support for co-mobile computing.

The semi-network OS architecture and related OSPU are specifically designed for network environment, which will not only be applied on computing device, but also be applied to some other electronic devices, such as TV set, therefore, it is beneficial to achieve the goal of that countless networked mobile devices are connected to network for serving different purposes, but they are no longer visible as traditional computing devices, such as desktop and notebook.

The semi-network OS architecture will take network as center to put all the operation of data storage, data extraction and other data processing together, then to realize the unification of database of whole networked mobile devices and network system, and ensures data consistency between network platform and local platform.

Many measures in semi-network OS architecture will be closely integrated and complemented together in OSPU, these measures not only include those components related to network validation, such as hardware code of OSPU, user personal identifiable information and other personalized data security setting, but also include many other measures taken by original hard disk, such as device drive and network connector, besides, the connection between OSPU and network no longer requires additional

application software to serve as a bridge, so it will be an opportunity for embedded OS, networked mobile devices, and co-mobile computing to be reformed or improved.

B. The semi-network OS architecture provides the operational convenience and innovation opportunities for co-mobile computing.

The concept of co-mobile computing includes three core elements: data computing system, networked mobile device and semi-network resources, among which semi-network resources belong to the combination of network server resources and local platform resources; the semi-network OS architecture is to promote the formation of new data computing system by utilizing the resources of network server and local platform, i.e. semi-network resources, and also it promotes the formation of new networked mobile device by using OSPU hardware components included in semi-network OS architecture.

Semi-network OS architecture and related OSPU can play their most efficient and comprehensive features when only the network being connected, thus, the data computing and generating on local platform surely to be inseparable from network, and some responsibilities that currently borne by local platform, or directly borne by user surely to be transferred to network server (such as software installing and maintenance).

Once network truly become center of local platform, the advantage of server resources and server system regulatory function would much more exceed a single local device, or a single user.

OSPU is also a regulation component for regulating overall operation of networked mobile device, which facilitates various types of data that originally stored in local platform to transfer to network server for storage, thus, the function of networked mobile device has more room to be increased, the size of networked mobile device also has more room to be reduced, so which will provide more opportunity for innovation of co-mobile computing.

C. The semi-network OS architecture is the most effective security means for co-mobile computing.

Semi-network OS architecture and related OSPU can resolve viruses and other issues that network brings to local platform, even, which can make network to be a security means to protect local platform, because data flow dominated by OSPU should be checked by server, and server is generally recognized to be more stringent security system than local platform, so it enhance the security level of co-mobile computing.

With semi-network OS architecture and related OSPU to be applied in co-mobile computing, networked mobile devices that installed base portion of semi-network OS

(similar to existing embedded OS) can also achieve multitasking without the need of free installation platform for software, such as hard disks.

Since local platform is no longer a free site to install software, and hard disk or similar device is no longer the carrier of OS, then viruses, hackers, phishing software will lost their activity place, lost their attack target, and lost their value of existence.

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