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TRANSPARENT COMPUTING ARCHITECTURE

Nidhi Joshi[1], Kalyani Anjankar[2], Aishwarya Deshpande[3]
[1]*Student,computerengineering department, J.D.I.E.T, Yavatmal,**heynidhi22@gmail.com***
[2]*Student, computerengineering department, J.D.I.E.T, Yavatmal,**kalyanianjankar01@gmail.com***
[3]*Student, computer engineering department, J.D.I.E.T, Yavatmal,**aishukd1996@gmail.com***

ABSTRACT
With the evolution of new technologies, the impact of smart phones, wearable devices, and mobile applications has been constantly changing our daily lives. Terminals are becoming more lightweight, intelligent, highly secure, and convenient devices. As an evolving computing paradigm, cloud computing focuses primarily on providing services through servers and networks but without addressing the inherent challenges and concerns of user terminals, such as energy efficiency, security, and cross-platform compatibility. Due to which, these challenges remain in the era of cloud computing and big data. Transparent computing is similar to cloud computing, transparent computing stores software and user data at specific servers. By adopting transparent computing paradigm, user terminals are becoming more lightweight with improved security, enhanced energy efficiency, and cross-platform capability. It is comprehensive survey and indicates future directions of transparent computing, from traditional terminals to mobile devices.

Keywords:-*Heterogeneous Services, Heterogeneous Terminal Support, Transparent computing.*

1. INTRODUCTION

As in the past 10 years, the evolution of new technologies such as cloud computing and big data has changed the main functions of computers and the Internet from computing and communicating to collecting, storing, analysing, and using various data and services. The dramatic increase in mobile devices and services provides significant opportunities and motivates the evolution of the computing paradigm from computers to mobile devices. However, new terminals and network environments also inset some new challenges. In the mobile Internet era, server-centric computing paradigms have been representative technologies, but they offer only partial solutions to certain problems. As an evolving computing paradigm, cloud computing focuses primarily on providing services through servers and networks but without addressing the inherent challenges and concerns of user terminals, such as energy efficiency, security, and cross-platform compatibility. These challenges remain in the era of cloud computing and big data.

Transparent computing, was first proposed in 2004 is a promising solution for addressing these challenges. The main idea is that all data and software, including OSs, apps, and user information, are stored on servers, with data computing performed on terminals. Transparent computing can be thought as a special kind of cloud computing that regards storage as a service. It splits the software stack from the basic hardware platform, and separates the computing unit from storage for the purpose of making the same software run on different hardware and different software run on the same hardware. It requires a unified software-hardware interface to abstract the basic platform details.

2. PROPOSED WORK

2.1Transparent Computing Architecture

Transparent computing lets users enjoy services via on-demand network access with any type of device, without needing to know the location of operating systems, middleware, and apps. This paradigm separates data storage and program execution in different PCs connected by communication networks. Data and software are stored and maintained by servers but executed on users' terminals. No OS, middleware, or application programs are installed on users' terminals; rather, they're dynamically loaded from the server through the network as per user's requests.

As Fig- 2.1 shows, transparent computing has an architecture consisting of service, OS, network, and terminal layers.

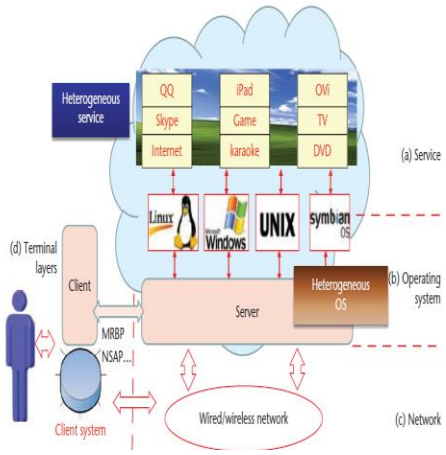

Fig- 2.1: Transparent Computing Architecture

2.1.1 Service Layer

In the service layer, software and user data are stored on servers. Services can be heterogeneous and are automatically associated with different basic operating systems; users can request any service inattentive of the basic operating system. Services can be deployed by download or user install, and they generally include a wide variety of options, such as games, instant messaging tools, and smart home apps.

2.1.2 Operating System Layer

The operating system layer stores heterogeneous operating systems. To support heterogeneous services, basic operating systems must be maintained by the servers. When a user requests a service, the servers automatically choose the basic operating system and select the operating system kernel, thereafter transmitting the kernel together with any requested service apps to the user's terminal. In general, both services and operating systems are stored on the servers that are responsible for managing operating systems, software, and user data. In transparent computing, computation and storage are spatiotemporally separated. Suitable operating systems and software are dynamically dispatched from the servers to users terminals and executed on the terminals in a buffer-enabled block or a streaming way.

2.1.3 Network Layer

The network layer controls communications and data transmission between servers and users. Software, Operating systems, and data are formed as blocks or streams that flow from the servers to user's terminals. Some communication protocols such as MRBP (Multi-OS Remote Booting Protocol) and NSAP (Network Service Access Protocol) have been developed to support remote booting and block transmission.

2.1.4 Terminal Layer

The fourth layer is responsible for receiving and executing services on user terminals, which are often diverse and frequently lightweight, ranging from PCs to Smartphone's or pads to wearable devices. The terminals need only store the underlying BIOS and a selection of protocols and management programs, thus enabling the terminals to be securely and easily managed and maintained.

2.2 Component of Transparent Computing

There are three main components of Transparent Computing are shown in Fig- 2.2 :

a. Transparent Computing Client: The client part of the Transparent Computing infrastructure, which in most cases is bare-metal for running different software stacks on the top.
b. Transparent Computing Server: It is backend of transparent computing infrastructure. Transparent Computing servers are used for the storage of software services to make them available to clients. It has features like infrastructure management; user identification and security are also provided here.
c. Transparent Computing Delivery Network: This is simply a network connection between transparent computing client and transparent computing server. The bandwidth of the transparent computing delivery network will significantly affect the overall performance.

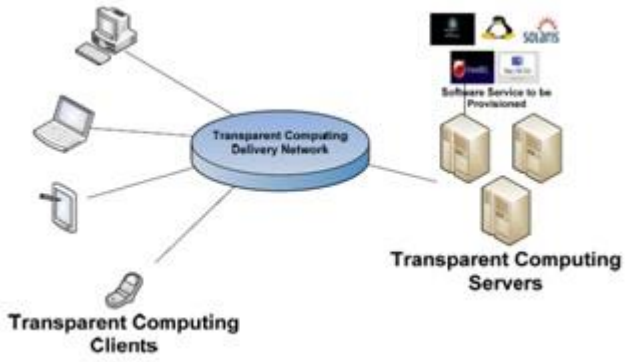

Fig- 2.2: Component of Transparent Computing

2.3. Illustration

Fig- 2.3 shows an example of heterogeneous terminal support. In this example, a Linux-supported calling service is stored on transparent servers and provided for user access. All OSs and apps stored on the servers are managed by Meta OS. Users need only install the Meta OS on their terminals; services, together with the supported OS (Linux), are transported to the terminals.

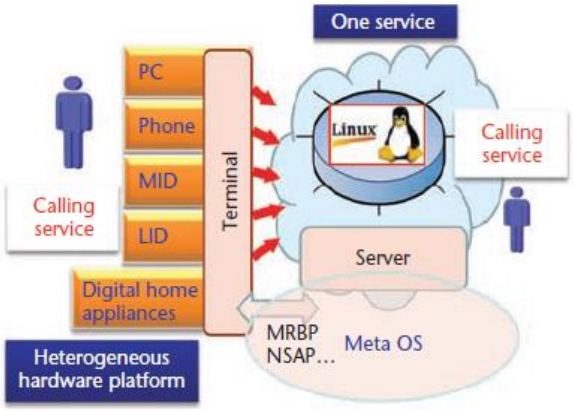

Fig-2.3: Heterogeneous Terminal support in transparent computing.

3.APPLICATION, ADVANTAGE &DISADVANTAGE

3.1 Application

Ti-Watch:

A research team at the Central South University of China released a smart watch, Ti-Watch, which is being developed based on the concept of mobile transparent computing. Because smart watches are usually associated with Smartphone's, Ti-Watch uses the associated smart phone as a transparent server while the watch itself acts as a transparent client. The data communication between Ti-Watch and the smart phone

is based on Bluetooth 4.1, and the watch's data computation is performed on demand in a page-streaming pattern. Based on this computing paradigm, Ti-Watch can run various apps smoothly with low-cost hardware and greatly improve energy efficiency. The battery life is reportedly longer than one week under normal usage.

Trans OS:

A Trans OS: a transparent computing-based operating system for the cloud. A cloud operating system Trans OS, from the viewpoint of transparent computing, in which all traditional operating system codes and applications are centrally stored on network servers, and an almost bare terminal dynamically schedules the necessary codes selected by users from the network server, and runs them mostly with the terminal's local resources. The Trans OS manages all the resources to provide integrated services for users, including traditional operating systems.

3.2Advantages

a. It reduces terminals complexity and cost.
b. It improves the user experience.
c. It offers a high level of security.
d. It offers cross-platform capability.

3.3 Disadvantages

a. Short battery Life.
b. Quality of connectivity.

4. CONCLUSION

As it's an IoT era, where lightweight and mobile devices become dominate terminals in the Internet and our daily life, it is gaining new opportunities, as well as new challenges, to exploit transparent computing from traditional terminals to mobile devices. Transparent computing is a promising computing paradigm in the current mobile computing era and will continue to attract increasing attention from both academia and industry. In transparent computing the main idea is to separate the computation, storage, and management of a traditional OS, applications, and services. To satisfy this goal, all the codes of a traditional OS and its applications are centrally stored and managed on a network server. Users can select any OS and application they want to run. It allows user to freely select and run whatever resources they desire.

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