Computing paradigms and related technologies have experienced significant changes due to rapid advances in computer hardware, software, and networking technologies. Recently, wearable devices and smartphones have dominated our daily lives, but server-centric computing paradigms, such as cloud computing, are increasingly providing services from servers and networks without addressing the inherent challenges and concerns of user terminals, such as energy efficiency, security, and cross-platform activities. Transparent computing is the latest phase of this evolution in system technology, with streaming scheduling and execution on user terminals providing platform-independent services.

Specifically, transparent computing utilizes data and software—from the OS to applications to user data—that are stored on servers. Computing performed at user terminals doesn’t depend on underlying hardware or implementation details. Rather, transparent computing extends bus transmission in traditional computer architectures to the network. Transmission efficiency and energy consumption are serious challenges, but researchers are starting to address these issues, and rapid advancement in wireless transmission could overcome existing difficulties. Although the road ahead seems rocky, transparent computing offers several advantages: reduction in user terminal complexity and cost, improvement in information security, and new cross-platform capabilities. The intention of this special issue is to provide a forum and to report up-to-date research and applications in this area.
In “Transparent Computing: A Promising Network Computing Paradigm,” Yaoxue Zhang and colleagues present a comprehensive survey and prediction about future directions. The article first reviews the key concept and the basic architecture of transparent computing, and then discusses existing work and several representative technologies, along with new challenges, potential research, and future applications.

In “NSAP+: Supporting Transparent Computing Applications with Service-oriented Protocol,” Shuang Li, Yuezhi Zhou, and Yaoxue Zhang analyze the quantitative benefits attributed to transparent computing and claim that the benefits can’t be assured in multiple terminal machine scenarios. The article proposes a proof-of-concept design of a service-oriented protocol over an existing transparent computing network architecture.

“Improving Scalability of Wearable Devices via Transparent Computing” by Letian Yi and colleagues presents a highly scalable system for power-efficient wearable devices called TCID (transparent computing-based intelligent device system). TCID eliminates the limitation on storage space size for program execution on a device by obtaining data from a server at runtime. To improve system performance, the article proposes adaptive network operations to deliver high network throughput for various data access patterns.

“CASP: A Context-Aware Transparent Active Service Provision Architecture in a Mobile Internet Environment,” by Kehua Guo, Yujian Huang, Li Kuang, and Yaoxue Zhang, describes a novel context-aware service provision architecture (CASP) that can actively provide suitable services to clients. The article presents a series of key technologies, including the client parameter acquisition scheme, user behavior analysis approach, and transmission optimization method.

“A Multilevel Access Control Scheme for Data Security in Transparent Computing,” by Tao Peng, Qin Liu, and Guojun Wang, proposes a multilevel access control scheme in transparent computing (MACTC) to protect user data with different security levels and provide multilevel access control and valid identity authentication.

Finally, in “TAM: A Transparent Agent Architecture for Measuring Mobile Applications,” Jiaqing Dong and colleagues propose a transparent agent architecture to monitor applications in terms of both network performance and content. TAM sets up distributed virtual agents for target mobile applications and enables parallel large-scale measurements through high-density computing resources.

The topics touched on in these articles highlight some exciting prospects for transparent computing. As we enter the Internet-of-Things era, in which lightweight mobile devices become the main online terminals in daily life, transparent computing promises great opportunities as well as new challenges. I hope you enjoy learning more about transparent computing, its applications, and possible extensions in the articles in this special issue.

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APPLICATIONS SYSTEMS ANALYST/PROGRAMMER

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