Beyond Global Communications: The Active World

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The confluence of pervasive computing, anywhere/anytime access to information resources and scalable computing enables the construction of smart environments or Active Spaces. In such a Space, a spectrum of computation and communication devices seamlessly augment human thought and activity with digital information, processing, and analysis to provide an observed or imagined world that is automated and enhanced by the behavioral context of its users. The power of such a computer infrastructure has three contributing factors; the translation of information to and from physical properties, the computers and their ability to transform data, and the cooperative computational environment that results from embedding these devices in a network. This computational environment or “Active World” is the likely long-term benefit of the current information technology revolution.

Several major projects have shown the benefits of considering pervasive computing environments within an infrastructure, constructed from computing elements that interact to form active or smart spaces, and managed by a software control system or meta-operating system to provide integrity and consistency. As a case study, our experimental system, Gaia, creates a pervasive computing environment that encompasses multiple rooms of our new building: the Siebel Center. Tasks like tours, exhibitions, seminars, lectures, or meetings are supported by coordinated distributed applications and both tasks and their contents may be programmed. Mobile users within the building are tracked with location sensors and may create sessions involving different tasks which they then may migrate, suspend, or resume as they move from room to room.

Despite recent advances, many challenges remain. Integrating the various services, components, applications, and entities into a programmable COTS infrastructure enables context sensitive applications that allow users to interact seamlessly with a combination of physical and computer facilities. Such an infrastructure of smart devices, rooms, and buildings raises the question of how to manage, program, automate, and formalize these heterogeneous sources, sinks, repositories, and processors of data. The organization, management, and programmability of physical devices and information activities in a pervasive computing environment is key to enabling diverse, autonomic, digital habitats such as university campuses, office buildings, scientific labs, and museums. However, the promise of pervasive computing cannot be realized without cost-effective and efficient mechanisms, policies, and tools to organize, manage, operate, repair, program, and evaluate systems built from pervasive computing components. Human tasks, human factors and pervasive system infrastructure interact in complex ways and methodologies need to be devised to explore and measure these interactions. In particular, a pervasive environment would need to enable opportunistic collaboration, facilitate social interaction, and support teaching and learning. This talk will explore the benefits of an Active World, the barriers to its deployment, and the research challenges that lie ahead.