Remote Instrumentation and Virtual Laboratories: Service Architecture and Networking

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Accessing remote instrumentation worldwide is one of the goals of e-Science. The task of enabling the execution of complex experiments that involve the use of distributed scientific instruments must be supported by a number of different architectural domains, which inter-work in a coordinated fashion to provide the necessary functionality. These domains embrace the physical instruments, the communication network interconnecting the distributed systems, the service oriented abstractions and their middleware. The Grid paradigm (or, more generally, the Service Oriented Architecture -- SOA), viewed as a tool for the integration of distributed resources, plays a significant role, not only to manage computational aspects, but increasingly as an aggregator of measurement instrumentation and pervasive large-scale data acquisition platforms. In this context, the functionality of a SOA allows managing, maintaining and exploiting heterogeneous instrumentation and acquisition devices in a unified way, by providing standardized interfaces and common working environments to their users, but the peculiar aspects of dealing with real instruments of widely different categories may add new functional requirements to this scenario. On the other hand, the growing transport capacity of core and access networks allows data transfer at unprecedented speed, but new challenges arise from wireless access, wireless sensor networks, and the traversal of heterogeneous network domains.

The book focuses on all aspects related to the effective exploitation of remote instrumentation and to the building complex virtual laboratories on top of real devices and infrastructures. These include SOA and related middleware, high-speed networking in support of Grid applications, wireless Grids for acquisition devices and sensor networks, Quality of Service (QoS) provisioning for real-time control, measurement instrumentation and methodology, as well as metrology issues in distributed systems.

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