Disaster Management Based on Urgent Computing and Dynamic Data Driven Application Services over European e-Infrastructures

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The study of natural hazards in Hydro-Meteorological Research (HMR) requires the execution of various meteorological, hydrological, and hydraulic models – either standalone or as well-orchestrated chains (workflows) – in order to better understand the natural phenomena leading to hazardous events. When hazards turn into disasters, exposure and vulnerability models need to be considered in addition for appropriate emergency response and recovery.

While it is possible to mitigate the impact of disasters through education, policies, infrastructure resilience, and real-time decision support systems, the need to go beyond the pure communication of timely information by the advanced use of optimization and simulation technology is increasingly accepted. In general, the focus of today's decision-support systems for disaster management is on pure situational awareness (i.e. communicating to decision makers the situation in the field as accurately as possible).

Experience from recent disaster cases, however, underpins the necessity of a novel, holistic approach to disaster management which not only needs to factor in the dependability of high performance computing resources and current advances in computational sciences (simulation, optimization), but also the dynamic integration of widely distributed (currently collected and archival) data into executing simulations to steer both the application model and further measurements (instrumentation and control). The first paradigm is commonly subsumed under "urgent computing (UC)", the latter one under "dynamic data driven application services (DDDAS)".

Both paradigms suffer from severe research challenges. In the talk we first introduce both paradigms using several disaster cases as examples. We then deduct from these cases the inherent research questions and present a brief survey of the state-of-the-art. The main part of the talk, however, will be devoted to the presentation of a "disaster management infrastructure" overlaying current European e-infrastructures which supports both the UC and the DDDAS paradigm.