

## **The Importance of Middleware for e-Research and e-Learning**

The next generation of research and learning will rely on collaboration across organisational boundaries. Whether for distributed teams in e-Research, or online classes in e-Learning, distributed collaboration presents a challenge for IT infrastructure where users come from different organisations. Middleware is a set of software services that sit above the network but below individual applications; it is often characterised as the “glue” that connects different systems together. One of the core elements of middleware is access and identity management, and this is particularly important for federated contexts such as distributed e-Research and e-Learning. This presentation will describe current and evolving middleware requirements for e-Research and e-Learning, with a focus on enabling distributed collaboration. It outlines the difficulties associated with traditional approaches, and their implications for security, privacy and user management. It then describes recent innovations in middleware (especially federated identity and access management) that provide solutions to existing problems, as well as enabling new kinds of distributed collaboration and related innovations. It concludes with a review of the wider implications for both e-Research and e-Learning from the new generation of middleware, and in particular, the potential for integration of e-Research and e-Learning to benefit the students of today, who will in turn become the researchers of tomorrow.