

OASIS 2008

Distributed development of large-scale global systems: Exploring the collaborative practices of particle physicists as they develop a Grid for the LHC

Authors: Avgousta Kyriakidou and Will Venters
London School of Economics and Political Sciences
Information systems and Innovation Group
Department of Management
Houghton Street, London
WC2A 2AE
London/UK

Grid computing promises to distribute and share computing resources “on tap” and provide transparent communication and collaboration between virtual groups (Foster and Kesselman 2003). Yet developing and implementing such complex information infrastructures requires collaboration among a range of dispersed groups, and flexibility and adaptability to volatile requirements (Berman, Geoffrey et al. 2003). Here, we examine a case-study of Grid development within particle physics, the LCG (Large hadron collider (LHC) Computing Grid), in an attempt to explore how such a large-scale distributed system is developed collaboratively in a global way in readiness for the launch of the LHC at CERN in September 2008. The particle physics community is well-known for the development of other cutting edge distributed systems (notably the web) and is itself highly distributed, so presenting a context where distinctive collaborative practices emerge.

Exploring this case we argue that the development of Grids poses new and underexplored opportunities for understanding global collaborative systems development. We therefore particularly examine the systems development practices of the particle physics community as it develops its Grid and the collaboration formed around this development with the aim to offer answers into the wider context of distributed development. We explore collaboration through three distinctive perspectives: creation/sharing of knowledge and expertise; creation of trust and in particular the balance of competitive relationships; innovation of new work practices and technology to support the work. In studying these, we consider practices as an emergent property linked to improvisation, bricolage and dynamic competences which unfold as large-scale projects evolve.

In this research we employ a range of theoretical concepts with a specific focus on communities of practice (Wenger 1998), practices (Schatzki, Knorr-Cetina et al. 2001), learning (Lave and Wenger 1991) and routines (Feldman 2000). Our theoretical framework is drawn from activity theory, which encompasses/focuses on such concepts (Nardi 1996), and frames the LCG project as a complex activity system influenced by the context, the community’s rules, norms, culture, history, past-experiences, shared-visions and collaborative practices. We propose to understand the Grid’s development as a series of contradictions between the elements of this activity system, which are in a continuous process of getting resolved in order for the activity system to achieve stability and balance. Contradictions are considered to be the major source of dynamism and development in activity theory (Bertelsen 2003), since based on the emerging problems and conflicts, people have to re-considered their position and collectively re-construct their shared understanding, knowledge and practices.

Evidence for this research is taken from over 70 semi-structured interviews with members of LCG, as well as observation of their major meetings/workshops. The research also draws upon literature from fields such as global systems development, open-source development, and global-outsourcing to provide concrete practical recommendations for those considering the collaborative development of large-scale systems, and provide suggestions for how such collaboration might be aided. It is hoped that the lessons learned from this community’s distributed collaborative development of a Grid might be able to describe a “new form” of systems development practice and thus inform IS-development literature.

ACKNOWLEDGEMENT: We would like to thank the LCG collaboration for providing generous access and assistance to our research. This research is undertaken as part of the Pegasus project (Particle-physics Engagement with the Grid: A Socio-technical Usability Study) funded by the UK EPSRC (Grant no EP/D049954/1). Further details available at: www.pegasus.lse.ac.uk

References

Berman, F., F. Geoffrey, et al. (2003). The Grid: past, present, future. In: Grid Computing- Making the Global Infrastructure a Reality. F. Berman, F. Geoffrey and T. Hey, John Wiley & Sons.

Bertelsen, O. W. (2003). Contradictions as a tool in IT-design: Some notes. 8th European conference of computer supported cooperative work (ECSCW), Helsinki, Finland.

Feldman, M. (2000). "Organizational Routines as a Source of Continuous Change." Organization Science **11**(6): 611-629.

Foster, I. and C. Kesselman (2003). The Grid in a Nutshell. In: Grid Resource Management – State of the Art and Future Trends. J. Nabrzyski, J. Schopf and J. Weglarz, Kluwer Academic Publishers.

Lave, J. and E. Wenger (1991). Situated learning: Legitimate Peripheral participation. New York, Cambridge university press.

Nardi, B. (1996). Context and Consciousness: Activity theory and human computer interaction. Cambridge, MIT Publisher.

Schatzki, T., K. Knorr-Cetina, et al., Eds. (2001). The Practice Turn in Contemporary Theory. London,UK, Routledge.

Wenger, E. (1998). Communities of practice: Learning, meaning and identity. Cambridge, United Kingdom, Cambridge University Press.