The Process Logic Underlying Enterprise Interoperability

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The science basis of Enterprise Interoperability is itself one of the four Grand Challenges of the Research Roadmap for the technologies needed for the Information Society but science is also an essential component of Knowledge-oriented Collaboration, Web Technologies and the proposed Interoperability Service Utility which together make up the other three Grand Challenges.

Interoperability consists of heterogeneous parts functioning as a coherent whole and with a continuing stability within a very dynamic global environment. The Roadmap may have many paths but all have to be connected dynamically. There can be no *cul de sac* and no disjoint track. Interoperability cannot build astride separate sciences but only on the common core science of them all. Interoperability forces us back to the very basis of science itself which is reason. Since the time of Aristotle, reasoning has been expressed as and traditionally presented in the formal language of mathematics. At foundation level therefore the grand Challenge of the Science Basis of Enterprise Interoperability is the question of its logic.

There is one strand of logic that has lain fairly dormant from even before Aristotle that is now brought to the fore in the full potency of the dynamic nature of interoperability. That is the Heracleitean notion of *Process*, a reality promoted in more recent times by Alfred North Whitehead after he and the third Earl Russell became disenchanted with the scientific basis of their *Principia Mathematica.* We need this revived scientific basis of process in its higher order open form for with globalisation we are no longer concerned with intra-operability contained within closed systems but with inter-operability between open systems. The closed world assumption of Gödel completeness has been adequate for the logic of closed systems but his undecidable theorems show that the logic of open systems needs to go beyond a mathematics of axioms, sets and number. This need for higher order systems science has already been identified by Table 1 of the Research Roadmap in its indicative research areas of the Science Base for Enterprise Interoperability, namely: systems/complexity science, network science, information science, web science, services science, economic science and social sciences.

These systems are all beyond the classical models (of first order predicate logic) that satisfy the closed world assumption of Gödel completeness They need the higher order process logic to be found in the categorial *Topos* that can integrate the Science Basis across all these systems as needed for Enterprise Interoperability. It can provide the necessary structural interfaces from the highest levels between Policy, Business and Technology down to the detailed design for data 'mashup' as well as provide the scientific bridge with the other three Grand Challenges.

The Topos as a closed cartesian category of categories has *process* to leverage the '-operability' and open *logic* to leverage the 'inter-' of 'interoperability'. This provides a consistent conceptual ecosystem with a rigorous formal scientific basis where Enterprise Interoperability can be reliably studied and developed with confidence and safety.