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The role of rules, requirements, and principles in the design of information infrastructures

Abstract

The contribution illustrates an architect's perspective on how information system design influences, mediates and translates ordering processes in society. It draws on the author's personal experience in the design of large public and/or private systems in segments of society like government, education, or agriculture over the past 30 years [1-5].
Taking a step back, we first consider one of the largest and most pervasive infrastructures today: civil aviation; and its fundamental building blocks: the Freedoms of the Air, the Rules of the Air, and the Standards and Recommended Practices for safety in aviation, developed in the Chicago Convention [6] and its 19 annexes since 1944. This body of globally implemented international agreements assembles respectively principles, rules, and requirements, three different kinds of statements that directly influence the way civil aviation functions as an infrastructure and, consequently, the way it orders the process of travelling by air in society.
Similarly, the information system architect must integrate rules (determined by the contractor), requirements (determined by engineers), and principles (determined by his/herself), in order to design a sustainable infrastructure. The paradox in system design is that requirements (or system constraints) should be relaxed to the largest possible extent in order to achieve sustainability (i.e., governance accepted by society).
This paradox is discussed using two opposing platform projects developed in the years 2016-2019, whose missions were each to build an infrastructure for the exchange of sensitive data between database operators in Swiss agriculture, under the provision that data owners, i.e., farmers, could authorize or impede each such transfer. The architect's approach (in one project) was based on rules and principles that subsequently determined loose constraints. The engineer's approach (in the other) was based solely on constraints that lead to a concentration of power (by using technical mechanisms of the Internet) which was rejected by users.

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Bio

I graduated in Mathematics at Neuchâtel University and in Computer Engineering at EPFL in Lausanne, where I earned my PhD in Distributed Computing Systems in 1992. I am lecturer and titulary professor of Computer Science (affiliated to the universities of Neuchâtel, Fribourg and Bern, as well as the BEJUNE normal school). Since my thesis, my work was concerned with designing distributed platforms for public or private entities, teaching, and to a lesser extent, publishing my work. I was CTO of the Swiss bureau of agriculture, where I lead the team that introduced the first nation-wide agricultural data management system in 1996, and between 1998 and 2001 of the Federal Ministry of the Economy. I designed Geneva's e-administration platform and worked on e-voting and e-education for the cantons of Geneva and Neuchâtel. I also contributed to the European ExoMars mission and designed a timepiece complication for the measure of time in 0-gravity. I have designed and lead the development of "smart technologies" and data-exchange infrastructures in large scale for agriculture in Switzerland and Brazil. One of these projects was the design of the peer-to-peer data-exchange platform in Swiss agriculture. Distribution, in the sense of "distributed computing" is the basis of sharing digital resources. Its characteristics, asynchrony and unreliable communication, limited interoperability of systems, dependencies and constraints, methods for resiliency, are a mirror of social interactions. My professional and research experience concern solving problems -in the real world (that of analogical actors and material resources) with the help of digital systems, without altering balances of power. The different sorts, the sharing and the usage of data as a means to bridge the gap between the analogical and digital worlds, and their interfaces, focus my interest.