Does System-of-Systems Thinking work for Self-Governance of Digitally Transforming Systems?

Abstract

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Digital appliances affect human life by the introducing information and communication technologies into all aspects of society. Empowering bottom-up for self-governing sociotechnical systems require to keep humans in the loop or even more important, to bring them back to the loop, meaning to encourage human-centered adoption of digital artefacts and socio-technical design. Based on the explored potential of design-integrated engineering of System-of-Systems (SoS) for handling the complex interplay of cyber-physical technologies and humans, this contribution discusses SoS-thinking as an approach to self-governance of cyber-physical infrastructures and digital appliances. Guiding principles are self-determination and shared autonomy for taking control and operating systems, in particular in collective interest. SoS development is discussed including the articulation of stakeholder interests, shifting them to digital twin modeling as (representational) baseline for design and engineering. Putting designs to practice consists of validating models and monitoring the operation of a cyber-physical system. Within the context of SoS thinking, several challenges need to be taken into account:

- how to identify and engage stakeholders for a particular situation or task
- how to design and implement transparent systems which facilitate intentional outcomes for stakeholders
- how to develop and protect intervention and interactive design capabilities
- how to achieve active alignment of interests and adjustment of intricate socio-technical constellation in highly interconnected and dynamically changing settings.

Different pathways to self-governance are reviewed and options for sustaining SoS thinking in cyber-physical development are considered. The conclusion discusses implications with respect to warranted participation in governance.