Beta PhD Symposium

Abstracts 24 November 2016

Museum Speelklok, Utrecht

10.15-10.35 hrs

Erwin van Wingerden (TU/e-IE&IS-OPAC)
Spare parts planning for two-echelon networks with lateral and emergency shipments
Discussants: Thomas Meyfroyt & Ramon Eliëns

We present a spare parts inventory model for a two echelon spare parts networks with lateral and emergency shipments. The network consists of a central warehouse, an emergency warehouse, and multiple local warehouses close to the customer(s). The order in which the local warehouses are checked is determined up front depending on the location of the warehouses. The emergency warehouse is used to provide the part through an emergency shipment in the case none of the local warehouses have stock. We present an approximate evaluation procedure to evaluate the two-echelon inventory system with lateral and emergency shipments.

10.35-10.55 hrs

Shaya Pourmirza (TU/e-IE&IS-IS)
Runtime Party Switch in an Inter-Organizational Collaboration
Discussants: Madis Talmar & Joey van Angeren

During the execution of an inter-organizational collaboration, a party may drop out for technical reasons or for business reasons. In such a case, the leaving party must be replaced, at runtime, by a new party. Ideally, the new party can pick up where the old party left off. To the best of our knowledge, very few attempts have been made which can help a new party in a collaboration to pick up where the old party left off. Designing such techniques constitutes a challenge due to each party's autonomy and to privacy policies that emerge in the context of a service collaboration.

This PhD study aims to address this challenge by providing an overview of the components, algorithms, operations and techniques that are necessary to enable a party in a collaboration to be replaced by another party at runtime. Accordingly, this study consists of the following three research activities. Firstly, it presents a descriptive reference architecture for Business Process Management Systems (BPMS) that facilitates switching parties in inter-organizational collaborations. This reference architecture, called BPMS-RA, has been designed based on a systematic literature review (SLR) of existing BPMS architectures. Secondly, it introduces a strategy for adapting an inter-organizational collaboration when a global view on the collaboration exists. In this strategy we assume that it is possible to have a central party, called the global controller, that can observe all communication and be the intermediary between all collaborating parties when one party is replaced by another. Finally, it describes a strategy for adapting an inter-organizational collaboration when a global view on the collaboration does not exist. The main challenge in this case is to capture the choreography model by relating the past communications among the collaborating parties that belong to the same thread of collaboration.

In order to demonstrate the feasibility of these studies, we have developed prototype tools that implement our solutions and we evaluated them in a practical setting.

10.55-11.15 hrs

Britt Mathijsen (TU/e-MCS)
Finite-size effects in critically dimensioned emergency departments
Discussants: Taimaz Soltani & Denise Tönissen

Motivated by the desire to determine staffing levels in an emergency department, we study a queueing model in which patients alternate between being in need of direct care from a nurse and being stable, while the total number of patients present in the ED is limited. We identify a two-fold scaling policy for which the system exhibits quality-and-efficiency-driven (QED) type behavior as it grows large, and approximate its performance through a fixed-point method. Building upon the asymptotic results, we ultimately propose a dimensioning scheme for the number of nurses and beds necessary to ensure good quality of care in both stationary and time-varying environments.

11.45-12.05 hrs

Samaneh Bagheri (TU/e-IE&IS-IS)
Knowledge transfer issues in co-creation value networks: multiple case studies
Discussants: Mohammadreza Zolfagharian & Freek Meulman

While knowledge recognized by co-creation value networks (VNs) as a main source of offering customized integrated solutions, many issues affects successful transfer of collective knowledge among the VNs' actors ranging from more organizational to more technical type of issues. In this research, we develop a comprehensive framework of value network knowledge transfer issues (VN-KTIs) in a structured way and investigate its practical relevance by identifying issues experienced by eight case studies. Each case is a value network consists of multiple service providers and their mutual customers. The triangulated data from different actors are collected and analysis.
The results of the identified KTIs in the various networks showed that 63% of the issues from the framework recurred in the same network. This means that if one of the actors in a network experiences an issue the others are likely to experience the same issue. If that is the case the network has to tackle the issue. The proposed KTIs framework provides a well-found basis for developing guidelines that enable value networks to early identify and prioritize potential issues in relation to knowledge transfer. The early identification of issues can support them in developing solutions in order to overcome issues. The framework also can guide information systems developers in extracting requirements from a well-defined basis, rather than from a chaotic ad hoc list of issues.

<u>12.05-12.25 hrs</u>

Joni Driessen (TU/e-IE&IS-OPAC)
Optimal Commonality and Reliability in Component Design - An After-Sales Services Perspective
Discussants: Shaya Pourmirza & Jori Selen

We consider a capital goods OEM who sells systems with complementary service contracts, and uses a platform strategy to reduce her costs. Her systems consist of components, belonging to a certain family. A component family is a collection of components that are very similar in their function, but not identical. For a repairable component family, the OEM has to determine: (1) whether to use a common component (one-for-all-systems) or dedicated components (one-for-each-system), (2) the reliability and (3) the turnaround stock levels for the components. The OEM's objective is to minimize the Life Cycle Costs (LCC).
We present two models: the common component model and the dedicated components model, and provide a detailed analysis of both. Both are not amenable for further analysis. Hence, we study two models, which are equivalent when the spare part unavailability cost approaches infinity. In our subsequent analysis, we derive a threshold for the relative costs of a common component, such that commonality yields lower LCC than dedicated components. Secondly, we analyze this threshold to show when it attains its maximum value. Finally, we prove the existence of a threshold that determines monotonicity in the optimal reliability levels of the common and dedicated components, for two practical special cases.

12.25-12.45 hrs

Meike Brehmer (TU/e KTH)
Business Model Transaction Systems of Sustainable Organizations
Discussants: Loe Schlicher & Arturo Perez Rivera

Climate change, loss of biodiversity, volatile energy and food prices, material scarcity, the financial and economic crisis as well as the continuing social injustice in the world require immediate action to ensure a more sustainable future. To achieve this organizations have to develop products and services that fulfill the consumers' needs while achieving maximized product usage, minimum material, water and energy usage and with reduced waste flows while also increasing social wealth throughout the supply chain and possibly of the end user. To be able to achieve this we not only need more environmentally sustainable product innovations but also more transparent and sustainable supply chains, as well as new business models. However, little insight exists into business models of sustainable organizations and what differentiates them from one another.

In this study we therefore explore further what differentiates sustainable organizations based on how they incorporate sustainability elements into their business models both in terms of environmental and social sustainability. In line with the transaction based view of the firm we focus on the transactions (e.g. value exchanges) between the focal organization and its key stakeholders and differentiate between the business model transaction system content, structure and governance. We do so by using a case study approach to analyze the business models of more than 60 Dutch sustainable organizations. We define them as organizations that reduce environmental pollution and / or increase social wealth relatively more than firms in their national business environment. We included both for-profit and non-profit organizations. Cases were selected among organizations that were distinguished for their sustainable innovation efforts either through awards, by being included in sustainable innovation rankings or because of high media attention. For each case a case report was written and the business model transaction system mapped based on archival data, the organizations' websites, the Dutch chamber of commerce and Lexis Nexis. In the next step the business model actors and the transactions were coded as being environmentally or socially sustainable, where applicable. Finally, the business model transaction system content, structure, and governance were compared between cases.

Our contribution is fourfold. First, we find that the underlying business model transaction system structures of sustainable organizations are the same as those known from for conventional for-profit firms. Second, we find that the broker business models in our sample, which mediate waste or products already in use, are intrinsically sustainable because they increase product use efficiency or give the goods a second life. Third, in comparison to environmental transaction content that is mainly of non-financial nature we find that social transactions, apart from those that are social interactions, are related to financially imbalanced transaction content exchanges. Finally, we find that choosing the transaction-based perspective of the business model is a valuable addition to the component-based view of the business model, and a valuable tool for mapping sustainability in business models.

14.00-14.20 hrs

Mohammadreza Zolfagharian (TU/e-IE&IS-ITEM)
Why, when and how to combine system dynamics with other methods: An evidence-based framework
Discussants: Mohammad Rasouli & Britt Mathijsen

Combining system dynamics (SD) with other methods serves to more profoundly articulate complex problems and explore potential solutions and policies for these problems. Although a significant number of SD studies has been drawing on multi-method approaches, there is a lack of knowledge with regard to why, when and how to make such combinations. We bridge this gap by means of a systematic literature review of studies that have combined SD with at least one other method. Our findings are synthesized in an evidence-based framework that serves to guide scholars in determining why, when and how SD can be effectively combined with other methods. Our review thus provides a point of reference for those who wish to go beyond stand-alone SD modeling. In addition, this paper contributes to the multi-methodology research and practice by consolidating one of the main areas where substantial experience in combining methods has been obtained.

14.20-14.40 hrs

Denise Tönissen (TU/e-IE&IS-OPAC)
Rolling Stock Maintenance Location Routing: Robust and Stochastic Programming Formulations
Discussants: Nardo Borgman & Gianmarco Bet

Rolling stock needs regular maintenance in a maintenance facility. Rolling stock from different fleets needs to be routed to maintenance facilities using interchanges between train lines and possible empty drives. We consider the problem of locating maintenance facilities in a railway network under uncertain or changing line planning, fleet planning and other factors. These uncertainties and changes are modeled by a discrete set of scenarios. We show that this new problem is NP-hard and provide a two-stage stochastic programming and a two-stage robust programming formulation. The second stage decision is a maintenance routing problem with similarity to a minimum cost-flow problem. We prove that the facility location decisions remain unchanged under a simplified routing problem and this gives rise to an efficient mixed integer programming (MIP) formulation. We also provide an accelerated Benders decomposition algorithm that uses these insights and bounds obtained from this MIP formulation. This result also allows us to find an efficient decomposition algorithm for the robust programming formulations based on scenario addition (SA). Computational work on instances of industrial size and larger shows that our improved MIP formulation outperforms Benders decomposition in computational time. SA improves the computational time for the robust formulation even further and can handle larger instances due to more efficient memory usage. Finally, we apply our algorithms to a case study at the Dutch railways.

14.40-15.00 hrs

Joey van Angeren (TU/e-IE&IS-ITEM)
Combining Free and Paid: Revenue Models in the Apple App Store
Discussiants: Wouter van Heeswijk & Fabio Cecchi

Value propositions in the mobile app industry tend to converge. In this generally level playing field, developers rely on the configuration of their revenue models as a way to differentiate their apps. Increasingly, they resort to perpetually free distribution models, with the intention of earning future revenues from customers' expenditures on additional app functionalities or from third-party advertising or affiliations. To determine how these revenue models affect downloads, a prerequisite for successful value appropriation, this study uses a weekly panel data set of 808,866 apps in the Apple App Store. The results account for endogeneity and show that as long as developers explicitly adopt some revenue model, app downloads increase. Downloads increase more with a revenue model based on free distribution, such that both customer and third-party–based revenue models can favorably affect downloads. However, combining customer- and third-party–based revenue models instead yields an attenuating effect.

15.00-15.20 hrs

Thomas Meyfroyt (TU/e-MCS)
Analysis of Degree-Dependent Counter-Based Gossip Protocols on Treelike Networks
Discussiants: Erwin van Wingerden & Jiwen Ge

In wireless networks, broadcasting is a basic functionality used to support many applications, like neighbor discovery, data dissemination, data aggregation and more. To this end, gossip protocols, have emerged as a reliable approach to implement broadcast. In particular, the use of counter-based gossiping schemes has proven to be a powerful technique for implementing highly scalable and robust services. Such schemes suppress broadcasts by a node, if the number of broadcasts it has already received exceeds some predefined threshold. In this presentation we analyze the probability thas a node's broadcast is suppressed during a single broadcasting round when a degree-dependent counter-based gossiping scheme is used. Specifically, we analyze the suppression probability of nodes in an infinite tree network, given the degree distribution of the tree. Furthermore, we propose an algorithm that determines how to configure the degree-dependent thresholds on infinite tree networks in order to reach some desired target suppression probabilities. Lastly, we show that the thresholds generated by the algorithm also perform remarkably well on finite non-tree networks and are robust to changes in the node-degree distribution and network topology.