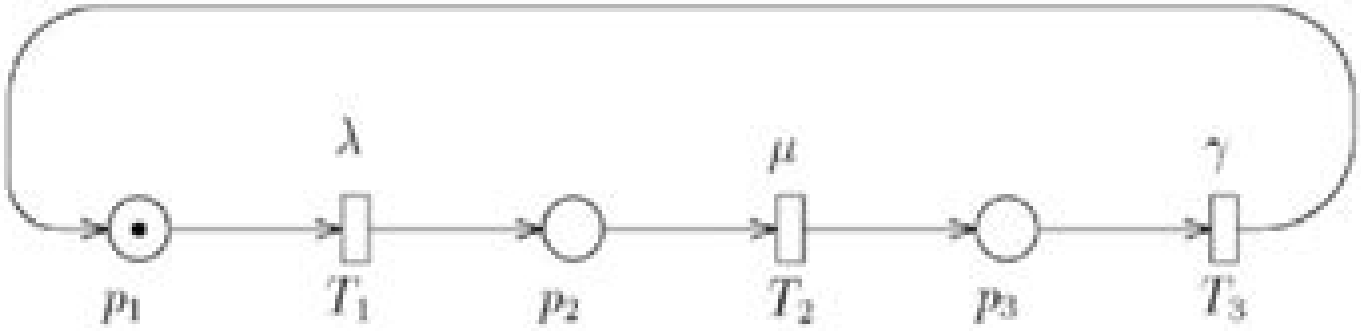
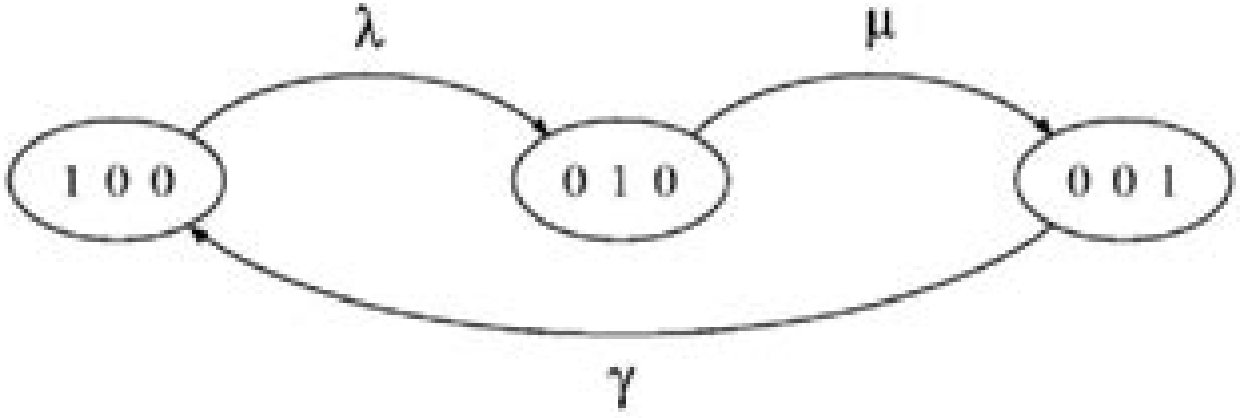
Stochastic Petri Nets …





Stochastic Petri Nets

P. J. Haas,G. S. Shedler

Stochastic Petri Nets:

Modelling with Generalized Stochastic Petri Nets M. Ajmone Marsan,1995-12-12 World renowned leaders in the field provide an accessible introduction to the use of Generalized Stochastic Petri Nets GSPNs for the performance analysis of diverse distributed systems Divided into two parts it begins with a summary of the major results in GSPN theory The second section is devoted entirely to application examples which demonstrate how GSPN methodology can be used in different arenas A simple version of the software tool used to analyse GSPN models is included with the book and a concise manual for its use is presented in the later chapters **Stochastic Petri Nets** Falko Bause,Pieter S. Kritzinger,1996 Any engineer who is responsible for the design and development of discrete systems such as embedded software for control or telecommunication systems knows that the most important quality of the final product is that it be functionally correct Once assured that the system behaves correctly it is also important that it be efficient in that its running cost is minimal or is optimum in whatever quanititive measure is chosen Stochastic Petri nets have been developes over the last decade with exactly these objectives in mind This book is an introduction to Stochastic Petri nets and arose out of a desire by the authors to collect all one needs to understand Stochastic Petri net theory in one volume The intention of this book is not to give an overview of several or all Stochastic Petri net models appearing in the literature but to stress a combined view of functional and performance analysis in the context of some Stochastic Petri net models The book contains a reference to several Stochastic Petri net tools which are available to help the reader apply the theory contained in this volume USP F r sicher funktionierende DV Systeme Stochastic Petri Nets Peter J. Haas,2006-04-10 Written by a leading researcher this book presents an introduction to Stochastic Petri Nets covering the modeling power of the proposed SPN model the stability conditions and the simulation methods Its unique and well written approach provides a timely and important addition to the literature Appeals to a wide range of researchers in engineering computer science mathematics and OR *Timed Petri Nets* Jiacun Wang,2012-12-06 Driven by the request for increased productivity flexibility and competitiveness modern civilization increasingly has created high performance discrete event dynamic systems DEDSs These systems exhibit concurrent sequential competitive activities among their components They are often complex and large in scale and necessarily flexible and thus highly capital intensive Examples of systems are manufacturing systems communication networks traffic and logistic systems and military command and control systems Modeling and performance evaluation play a vital role in the design and operation of such high performance DEDSs and thus have received widespread attention from researchers over the past two decades One methodology resulting from this effort is based on timed Petri nets and related graphical and mathematical tools The popularity that Petri nets have been gaining in modeling of DEDSs is due to their powerful representational ability of concurrency and synchronization however these properties of DEDSs cannot be expressed easily in traditional formalisms developed for analysis of classical systems with sequential behaviors This book introduces the theories

and applications of timed Petri nets systematically Moreover it also presents many practical applications in addition to theoretical developments together with the latest research results and industrial applications of timed Petri nets Timed Petri Nets Theory and Application is intended for use by researchers and practitioners in the area of Discrete Event Dynamic Systems **Stochastic Petri Nets** Peter J. Haas,2004 Stochastic Petri nets have proven to be a useful tool for modelling and performance analysis of complex discrete event stochastic systems such as those in telecommunications manufacturing transportation This monograph centres on techniques for the modelling and computer simulation of such systems

Modelling with Generalized Stochastic Petri Nets Marco Ajmone Marsan,2002 **Stochastic Petri Nets for Wireless Networks** Lei Lei,Chuang Lin,Zhangdui Zhong,2015-04-08 This SpringerBrief presents research in the application of Stochastic Petri Nets SPN to the performance evaluation of wireless networks under bursty traffic It covers typical Quality of Service performance metrics such as mean throughput average delay and packet dropping probability Along with an introduction of SPN basics the authors introduce the key motivation and challenges of using SPN to analyze the resource sharing performance in wireless networks The authors explain two powerful modeling techniques that treat the well known state space explosion problem model decomposition and iteration and model aggregation using stochastic high level petri nets The first technique assists in performance analysis of opportunistic scheduling Device to Device communications with full frequency reuse and partial frequency reuse The second technique is used to formulate a wireless channel mode for cross layer performance analysis in OFDM system Stochastic Petri Nets for Wireless Networks reveals useful insights for the design of radio resource management algorithms and a new line of thinking for the performance evaluation of future wireless networks This material is valuable as a reference for researchers and professionals working in wireless networks and for advanced level students studying wireless technologies in electrical engineering or computer science *Application and Theory of Petri Nets 1993* Marco Ajmone Marsan,1993-06-07 This volume contains the proceedings of the 14th International Conference onApplication and Theory of Petri Nets The aim of the Petri net conferences is to create a forum for discussing progress in the application and theory of Petri nets Typically the conferences have 150 200 participants one third of whom come from industry while the rest are from universities and research institutes The volume includes three invited papers Modeling and enactment of workflow systems C A Ellis G J Nutt Interleaving functional and performance structural analysis of net models M Silva and FSPNs fluid stochastic Petri nets K S Trivedi V G Kulkarni together with 26 full papers selected from 102 submissions and 6 project papers Stochastic Petri Net Models: Simultaneous Transition Firing P. J. Haas,G. S. Shedler,1990 Abstract Stochastic Petri nets with timed and immediate transitions have at least the modelling power of generalized semi Markov processes and provide a general framework for discrete event simulations on a countable state space In this context the marking assignment of token counts to the places of the net corresponds to the state of the underlying stochastic process of the simulation The firing of a transition corresponds to the occurrence of an event so that a

marking change occurs when one or more transitions fire simultaneously This paper focuses on stochastic Petri nets in which transitions can fire simultaneously Stochastic Petri Nets Gérard FLORIN,1991 *Stochastic Petri Net Models* Peter Jerome Haas,Gerald S. Shedler,1991 Abstract Generalized semi Markov processes and stochastic Petri nets provide building blocks for specification of discrete event system simulations on a finite or countable state space The two formal systems differ however in the event scheduling clock setting mechanism the state transition mechanism and the form of the state space In this paper we show that stochastic Petri nets and generalized semi Markov processes have the same modeling power Combining this result with known results for generalized semi Markov processes we also obtain conditions for time average convergence and convergence in distribution along with a central limit theorem for the marking process of a stochastic Petri net **Discrete Deterministic and Stochastic Petri Nets** National Aeronautics and Space Administration (NASA),2018-07-02 Petri nets augmented with timing specifications gained a wide acceptance in the area of performance and reliability evaluation of complex systems exhibiting concurrency synchronization and conflicts The state space of time extended Petri nets is mapped onto its basic underlying stochastic process which can be shown to be Markovian under the assumption of exponentially distributed firing times The integration of exponentially and non exponentially distributed timing is still one of the major problems for the analysis and was first attacked for continuous time Petri nets at the cost of structural or analytical restrictions We propose a discrete deterministic and stochastic Petri net DDSPN formalism with no imposed structural or analytical restrictions where transitions can fire either in zero time or according to arbitrary firing times that can be represented as the time to absorption in a finite absorbing discrete time Markov chain DTMC Exponentially distributed firing times are then approximated arbitrarily well by geometric distributions Deterministic firing times are a special case of the geometric distribution The underlying stochastic process of a DDSPN is then also a DTMC from which the transient and stationary solution can be obtained by standard techniques A comprehensive algorithm and some state space reduction techniques for the analysis of DDSPNs are presented comprising the automatic detection of conflicts and confusions which removes a major obstacle for the analysis of discrete time models Zijal Robert and Ciardo Gianfranco Langley Research Center NAS1 19480 DFG 1257 7 1 **Discrete-time Markovian Stochastic Petri Nets** Gianfranco Ciardo,Institute for Computer Applications in Science and Engineering,1995 Abstract We revisit and extend the original definition of discrete time stochastic Petri nets by allowing the firing times to have a defective discrete phase distribution We show that this formalism still corresponds to an underlying discrete time Markov chain The structure of the state for this process describes both the marking of the Petri net and the phase of the firing time for of sic each transition resulting in a large state space We then modify the well known power method to perform a transient analysis even when the state space is infinite subject to the condition that only a finite number of states can be reached in a finite amount of time Since the memory requirements might still be excessive we suggest a bounding technique based on truncation Markovian

Stochastic Petri Nets Peter Jerome Haas,Gerald S. Shedler,1989 Abstract Stochastic Petri nets are particularly well suited to representation of concurrency synchronization and communication We show that the marking process of a stochastic Petri net is a time homogeneous continuous time Markov chain with countable state space provided that the clock associated with the firing of each timed transition is always set according to a fixed exponential distribution The result rests on a representation of the conditional distribution of the vector of clock readings given the partial history of the process We also investigate the modelling power of Markovian stochastic Petri nets The main result is that for any possibly non Markovian finite state generalized semi Markov process with exponential clock setting distributions there exists a Markovian stochastic Petri net with deterministic transitions and unit speeds having a marking process with the same finite dimensional distributions Analysis of Phase-Type Stochastic Petri Nets with Discrete and Continuous Timing National Aeronautics and Space Administration (NASA),2018-05-29 The Petri net formalism is useful in studying many discrete state discrete event systems exhibiting concurrency synchronization and other complex behavior As a bipartite graph the net can conveniently capture salient aspects of the system As a mathematical tool the net can specify an analyzable state space Indeed one can reason about certain qualitative properties from state occupancies and how they arise the sequence of events leading there By introducing deterministic or random delays the model is forced to sojourn in states some amount of time giving rise to an underlying stochastic process one that can be specified in a compact way and capable of providing quantitative probabilistic measures We formalize a new non Markovian extension to the Petri net that captures both discrete and continuous timing in the same model The approach affords efficient stationary analysis in most cases and efficient transient analysis under certain restrictions Moreover this new formalism has the added benefit in modeling fidelity stemming from the simultaneous capture of discrete and continuous time events as opposed to capturing only one and approximating the other We show how the underlying stochastic process which is non Markovian can be resolved into simpler Markovian problems that enjoy efficient solutions Solution algorithms are provided that can be easily programmed Jones Robert L and Goode Plesent W Technical Monitor Langley Research CenterPETRI NETS MARKOV PROCESSES SYNCHRONISM ALGORITHMS *Extended Stochastic Petri Nets* Joanne Bechta Dugan,1984 An Extended Stochastic Petri Net ESPN model useful for modeling systems which exhibit concurrent asynchronous or nondeterministic behavior is developed Applications demonstrating the flexibility of the model for a variety of system modeling applications are presented Analytic techniques for the representation of a class of ESPNs as Markov or semi Markov processes are discussed as is the simulation of more general models Finally DEEP the Duke ESPN Evaluation Package is previewed Author Discrete-time Markovian Stochastic Petri Nets Gianfranco Ciardo,Institute for Computer Applications in Science and Engineering,1995 Abstract We revisit and extend the original definition of discrete time stochastic Petri nets by allowing the firing times to have a defective discrete phase distribution We show that this formalism still corresponds to an underlying discrete time Markov chain The structure of the state for this

process describes both the marking of the Petri net and the phase of the firing time for of sic each transition resulting in a large state space We then modify the well known power method to perform a transient analysis even when the state space is infinite subject to the condition that only a finite number of states can be reached in a finite amount of time Since the memory requirements might still be excessive we suggest a bounding technique based on truncation Software Development for Analysis of Stochastic Petri Nets Using Transfer Functions Aman U. Jamwal,1991 This thesis research is an implementation of a closed form analytical technique for study evaluation and analysis of Stochastic Petri Nets SPN The technique is based on a theorem that an isomorphism exists between an SPN and a Markov Chain The procedure comprises five main steps reachability graph generation of the underlying Petri net transformation of the reachability graph to a state machine Petri net calculation of transfer functions computation of equivalent transfer functions via Mason s rule and computation of performance parameters of the SPN model from the equivalent transfer functions and their derivatives The software is developed in UNIX using C and applied to various SPN models Future research includes implementation of Mason s rule for complex cases and symbolic derivation of equivalent transfer functions **Regenerative Stochastic Petri Nets** International Business Machines Corporation. Research Division,P. J. Haas,G. S. Shedler,1984 The stochastic Petri net SPN framework permits formal specification of many discrete event simulations We define an SPN as a stochastic process and using structural properties of the SPN and recurrence theory for generalized semi Markov processes establish conditions which ensure that an SPN is a regenerative process and that the expected time between regeneration points is finite Steady state estimation procedures for ring network simulations follow from these results Keywords include regenerative simulation stochastic Petri nets generalized semi Markov processes recurrence and regeneration and ring networks **Stochastic Petri Nets with Simultaneous Transition Firings** International Business Machines Corporation. Research Division,P. J. Haas,G. S. Shedler,1987

Stochastic Petri Nets Book Review: Unveiling the Magic of Language

In an electronic era where connections and knowledge reign supreme, the enchanting power of language has be much more apparent than ever. Its ability to stir emotions, provoke thought, and instigate transformation is actually remarkable. This extraordinary book, aptly titled "**Stochastic Petri Nets**," compiled by a highly acclaimed author, immerses readers in a captivating exploration of the significance of language and its profound effect on our existence. Throughout this critique, we shall delve to the book is central themes, evaluate its unique writing style, and assess its overall influence on its readership.

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Stochastic Petri Nets Introduction

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