

# Strategies for the Implementation of Resilient High Functional Importance Socio-Technical Systems

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## Abstract

This paper presents some interdisciplinary researches developed at the EUROQUALROM laboratory in the frame of the research project "Socio-technical systems resilient to errors / fault"; these researches had as purpose to improve the dependability (and especially its main components – reliability and safety/security) of socio-technical systems, mainly through the use of errors/fault tolerance and resilience attributes. Resilience to failures and deliberate attacks is becoming an essential requirement in most communication networks today. The main concepts and models regarding the socio-technical systems and dependability are analysed in the first part of the paper. In the second part of the paper, some strategies for the implementation of resilient structures to assure the safety / security of high functional important structures are proposed. These strategies are finally applied in the case of data transmission systems.

**Keywords:** Concept, Model, Dependability, Reliability, Safety, Security, High functional importance systems, Socio-technical systems, Data transmission systems, Resilience

## References:

- [1] Angelica Bacivarov, I. C. Bacivarov, Asupra siguranței în funcționare a sistemelor sociotehnice tolerante la erori/defectari, în ASIGURAREA CALITĂȚII - QUALITY ASSURANCE Anul XIV, Numarul 56, Octombrie - Decembrie 2008, SRAC, , pp12-19, ISSN 1224 – 5410
- [2] I. C. Bacivarov, Angelica Bacivarov, Un proiect de cercetare interdisciplinar în domeniul siguranței în funcționare a sistemelor socio-tehnice reziliente, în QUALITY and DEPENDABILITY - Proceedings of the 11th IEEE International Conference în Quality and Dependability, Sinaia, 2008, MEDIAREX, ISSN 1842-3566, pg. 128-136;
- [3] Catuneanu V, Bacivarov, I, C., Fiabilitatea sistemelor de telecomunicatii, Editura Militara, Bucuresti, 1985
- [4] Angelica Bacivarov, G. Petrică, Reliability Modeling of a Complex System Considering Human Factor, în QUALITY and DEPENDABILITY - Proceedings of the 11th IEEE International Conference în Quality and Dependability, Sinaia, 2008, MEDIAREX, ISSN 1842-3566, pg. 115-120
- [5] Daniel J. Rosenkrantz<sup>1</sup>, Sanjay Goel<sup>2</sup>, S.S. Ravi, Jagdish Gangolly, Structure-Based Resilience Metrics for Service- Oriented Networks, Dependable Computing –EDCC-5, Lecture Notes în Computer Science, Volume 3463/2005,pp 345-362
- [6] I. Nastac, Angelica Bacivarov, A. Costea, A Neuro- Classification Model for Socio-Technical Systems, în Romanian Journal of Economic Forecasting, ISSN 1582-6163,

- [7] David M. Clarke, Human redundancy in complex, hazardous systems: A theoretical framework, *Safety Science* 43 (2005) 655–677
- [8] J. C. Laprie, ReSIST: resilience for survivability, an overview, First Open Workshop ReSIST: Resilience for Survivability in IST, Budapest, 21-22 March 2007.
- [9] B. Gedik and L. Liu, .Reliable Peer-to-Peer Information Monitoring Through Replication Proc. 22nd IEEE Symposium on Reliable Distributed Systems (SRDS'03), Florence, Italy, Aug. 2003.
- [10] Howard Lipson, "Evolutionary Systems Design: Recognizing Changes in Security and Survivability Risks", CMU/SEI- 2006-TN-027, Technical Report, 2006
- [11] Richard C Linger, Howard F. Lipson, John McHugh, Nancy R. Mead, Carol A. Sledge; Life-Cycle Models for Survivable Systems, CMU/SEI-2002-TR-026, Networked Systems Survivability Program, Carnegie Mellon University, 2002
- [12] C.M. Chen, C.W. Lin and Y.C.Chen. Adaptive error resilience transcoding using prioritized intra-refresh for video multicast over wireless networks. *Signal Processing: Image and Communication*, 22, 277-297, 2007.
- [13] H. Nakayama, N. Ansari, A. Jamalipour and N. Kato. Faultresilient sensing in wireless sensor networks. *Computer Communication*, 30, 2375-2384, 2007.
- [14] F. Vanderhaegen. *Analyse et contrôle de l'erreur humaine*. Hermès Science, 2003.
- [15] Alexander C. (2003) *Operational Risk, regulation analysis and management*, Prentice Hall, London
- [16] Cornalba C. and Giudici P. (2007) Statistical models for operational risk management, *Physica A*, 338, 166–172
- [17] PAS56 (2003) *Guide to business continuity management, Guidelines*, British Standard Institute
- [18] [www.unipv.it/dipstea/workingpapers/43.pdf](http://www.unipv.it/dipstea/workingpapers/43.pdf)
- [19] [http://en.wikipedia.org/wiki/Bayesian\\_network](http://en.wikipedia.org/wiki/Bayesian_network)
- [20] La Sala, K.P., RAC Publication .A Practical Guide to Developing Reliable Human Machine Systems and Processes., January 2002.
- [21] Swain, A.D., "THERP", SC-R-64-1338, Sandia National Laboratories, Albuquerque, NM, August 1964.
- [22] Dhillon B. S., Rayapati S. N., Probabilistic analysis of redundant systems with human errors and common-cause failures, *Stochastic Analysis and Applications*, Volume 4, Issue 4 1986 , pages 367 – 398
- [23] Nastac, I., "An Adaptive Retraining Technique to Predict the Critical Process Variables", TUCS Technical Report, (<http://www.tucs.fi/research/series/serie.php?type=techreport&year=2004>).
- [24] M. H. Al-Kuwaiti, N. Kyriakopoulos, S. Hussein, Towards a Standardized Terminology for Networks Performance, *IEEE Transactions on Reliability*, June 2008 vol.57 no.2 pp.267- 270;
- [25] Florentina Lincă, Angelica Bacivarov, I. C. Bacivarov, "Risk Management in Complex High Functional Importance Systems", in *QUALITY and DEPENDABILITY - Proceedings of the 11th IEEE International Conference in Quality and Dependability*, Sinaia, 2008, MEDIAREX, 2008, ISSN 1842-3566, pg. 280-288
- [26] I. C. Bacivarov, I.C. Mihai, Survivability Analysis of Informational Systems, in *QUALITY and DEPENDABILITY - Proceedings of the 11th IEEE International Conference in Quality and Dependability*, Sinaia, 2008, MEDIAREX, ISSN 1842-3566, pg. 151-158;
- [27] C. Ciuchi, Angelica Bacivarov, I. C. Bacivarov, G. Petrică, Decisional Strategies and Algorithms, in *QUALITY and DEPENDABILITY - Proceedings of the 11th IEEE International Conference in Quality and Dependability*, Sinaia, 2008, MEDIAREX, ISSN 1842-3566, pg. 159-163;
- [28] Dorina Luminița Copaci, C. A. Copaci, I. C. Bacivarov, RDQOS: Resilience Differentiated – Quality of Service, in *QUALITY and DEPENDABILITY - Proceedings of the 11th IEEE International Conference in Quality and Dependability*, Sinaia, 2008, MEDIAREX, 2008, ISSN 1842-3566, pg. 93-98;

- [29] Florentina Linca, I. C. Bacivarov, Angelica Bacivarov, Analiza riscului în sistemele tehnice complexe în ASIGURAREA CALITATII - QUALITY ASSURANCE Anul XIV Numarul 53 Ianuarie-Martie 2008, p 22-31
- [30] <http://en.wikipedia.org/wiki/Resilience>
- [31] [site/erikhollnagel2/whatisresilienceengineering%3F](http://site/erikhollnagel2/whatisresilienceengineering%3F)
- [32] Angelica Bacivarov, Ioan C. Bacivarov, Cercetări privind reziliența sistemelor socio-tehnice, pag. 17-26.