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STATE FAILURE AS A FACTOR IN INTERNATIONAL GLOBAL COUNTERACTING OPERATIONS: NETWORK MODELING

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In the paper are considered the need for build cooperation and collaboration among all entities and actors. Comprehensive Network Lace is based on an end-to-end description of major categories of interactions for sets of entities using a multilayer (multi-level) variety of complex networks.

Keywords: *complex networks, mapping, graphical representations, counteract disasters, emergency management.*

Introduction

In order to counteract disasters and emergencies it is necessary to build cooperation and collaboration among all entities and actors. While this headquarters and field teams of rescues feel need of supporting State power at the place of an event.

Cooperation and collaboration, i.e. information sharing and integration based on new ICT approaches are of value for the most sensitive fields:

- Disaster Medicine
- Intelligence Services

US State power for Intelligence:

Catalyst program will support IC information sharing and integration objectives

Information Sharing: Office of the Director of National Intelligence

2010 Data Mining Report

For the Period January 1, 2010 through December 31, 2010

ODNI Civil Liberties and Privacy Office (CLPO) works closely with the ODNI Office

CLPO has been considering how advanced technologies, employed in accordance with proper laws and policies, enable sharing and use of information while protecting privacy and civil liberties.

Haiti Earthquake case demonstrated lack of a State power and concomitant difficulties for international rescuers which had encountered with. Thus the problems in the Disaster field are not only of Natural and Technological aspects but those of Social and Political.

It has been a time to explore the role of State power impact on national and international counteracting Global Disasters and Emergencies. One of the modern and fruitful analysis instruments for complicated social and group processes is Complex Network modeling.

In any discipline the large number of participants – subjects, objects, actors – and their relationships (interactions) suggests that such a set (chain) of interacting entities itself has some common fundamental features.

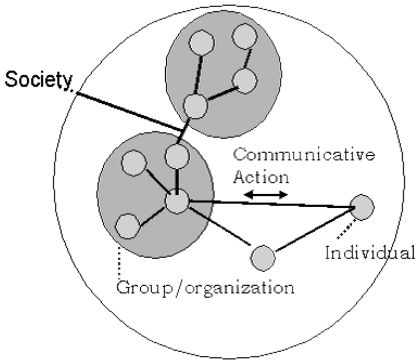

Fig. 1. Subjects and objects of networks

These network properties of the set, depend on its structure, rather than on internal contents of individual entities.

While math graph theory studies structural properties, interdisciplinary intersection has formed a new filed: theory of networks.

Applications of the theory of networks find themselves wherever there is a network, i.e. everywhere.

Examples of meaningful and relevant networks are:

Internet; WWW; Network Governance, Economic Network, Social Networks, Knowledge Networks; Political networks, TV networks, National and local transportation routes (air, rail, water, metro, bus, tram); Electrical network; Communications (postage, telephone); Thermal network water supply and sanitation; Trade networks; webs of nervous system; intelligence networks; terrorist networks.

US State power for the National Security

Discovery of unknown terrorism relationships:

Office of the Director of National Intelligence

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National Counterterrorism Center (NCTC) uses network analysis tools to discover relationships between Known and Suspected Terrorists (KST) and their associates.

A new program known as DataSphere will enhance data fusion and entity resolution, as well as discovery of unknown relationships. DataSphere, enables analysis of the activities of terrorists such as their communication networks and travel.

Advances in Theory and Practice of Networks

Graph Theory originated in the moment when Leonhard Euler, Swiss, German and Russian mathematician, decided to prove that a passerby can not get around Konigsberg (modern Kaliningrad), using only one each of the seven city bridges.

Its key conclusion is: structural characteristics of graphs (networks) define a potential for their use.

The first example of using the methods of modern algebra in graph theory accounts for the work of the physicist Gustav Robert Kirchhoff, in 1845 he formulated so called Kirchoff's laws to calculate voltages and currents in electrical circuits.

Mathematician Dénes Kőnig published in 1936 a book titled "Theory of finite and infinite graphs” – the first textbook in the field of graph theory.

Introduction of probabilistic methods in graph theory, especially in research of Paul Erdős and Alfréd Rényi on asymptotic probabilities of graphs created another branch known as theory of random graphs.

Modern complex systems are attributed by high number of elements, which can reach tens and hundreds of thousands, and irregular ties.

The term "complex" is the best for such systems and their network models with non-trivial topological properties.

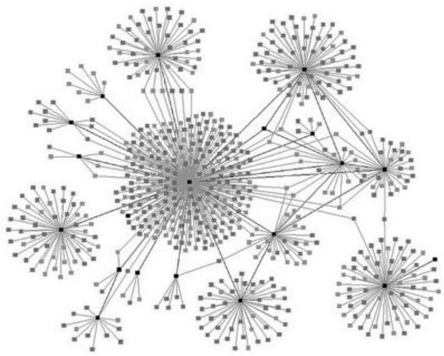

Fig.2. Integrated complex networks

Resilience of network architecture is one of the major problems of building effective complex social, biological, technical and other systems.

Graphical representation of [A.-L. Barabási, R. Albert, H. Jeong. Mean-field theory for scale-free random networks. Physica. 1999, A 272, P. 173-187] bypassed the whole world, and is widely used to demonstrate the exponential (a) and scale-free (b) networks.

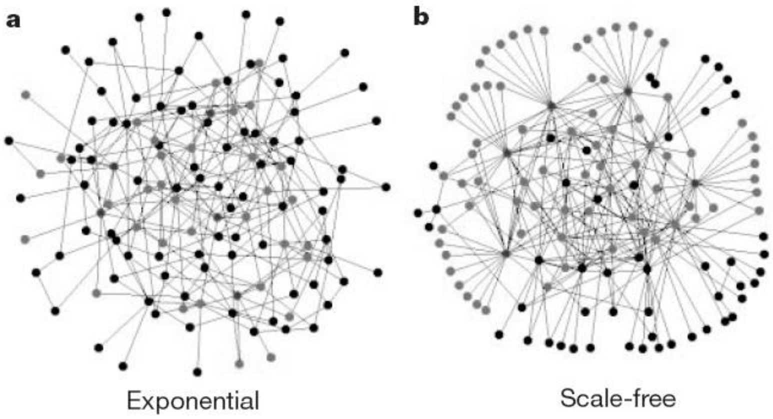

Fig.3. Graphical representation of network

Complex Network tools have been successfully applied to understanding and counteracting such threats as infection diseases spread and terrorist activity. Contrary another significant utilization of Complex Network approach is to develop good governance, management and organizational processes in international, national and corporation landscapes.

Martin Rosvall† and Carl T. Bergstrom. An information-theoretic framework for resolving community structure in complex networks. PNAS. May 1, 2007, vol. 104, N 18, 7327–7331

Problems and limits of applicability of Current Network Models

Complex Network ideas have been steadily and successfully applied to the analysis of metabolic and genetic regulatory networks, in developing reliable scalable networks of wired and wireless communications, for development of vaccination strategies in fight against diseases, as well as a wide range of other practical issues.

However, neither in public nor in the corporate governance these ideas have not been applied widely and significantly. Many problems of modeling of organizational structures and cross-sectoral governance are resolved, the issues of control of complex networks continue to be complex and daunting.

This can be seen in the discussion of various approaches in directing of the Internet Governance Forum network (IGF).

Most biosocial systems are characterized by some degree of inequality of individuals, so that part of the system, individuals differ in their (Bio) Social ranks. Set of ranks-hierarchy- forms special relationships and their correspondent performance – hierarchical one. Hierarchical and egalitarian structures in many biosocial systems coexist and continually interact with each other.

Often one and the same biosocial system is considered by researchers and practitioners from different points of view: depending on the preferences the focus is either hierarchy with domination and subordination, or presence of equal relations in the system.

Researchers constantly faces with the competing nature of networks and their contrasting.

Many distributed systems, particularly cellular networks, computer networks and the Internet possess developed topologies and are based on complex and diverse social processes.

According to the founder of the technology of World Wide Web T. Berners-Lee, the next step in the development of the World Wide Web can be a GGG «Giant Global Graph." Berners-Lee believes that such a graph, in contrast to a network of computers and the WWW, linking documents, interconnected people and, based on semantic technologies that provide users with services of higher class than the existing one.

Comprehensive networks as a new approach in studying of huge and especially Complex Systems

The concept of Comprehensive Network Lace CNL is based on an end-to-end description of major categories of interactions for sets of entities (subjects and objects) using a multilayer (multi-level) variety of complex networks.

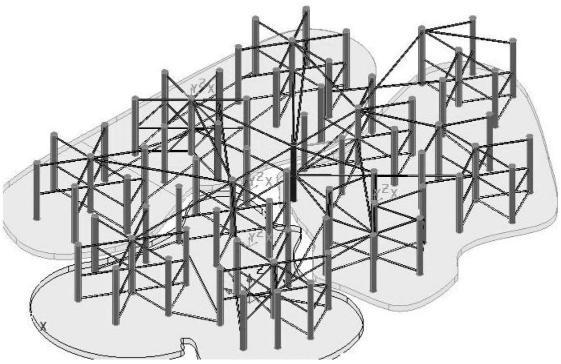

Fig.4. The approach of pair interactions of subjects (actors) in a separate thematic layers (TL)

The core of the approach is binary interactions of entities (actors) in a separate thematic layers (TL).

In simple words, graph is a set of points (for convenience, the image – on the plane) and linked in pairs by lines, the CNL – is a set of points in the different thematic planes and corresponding joint lines.

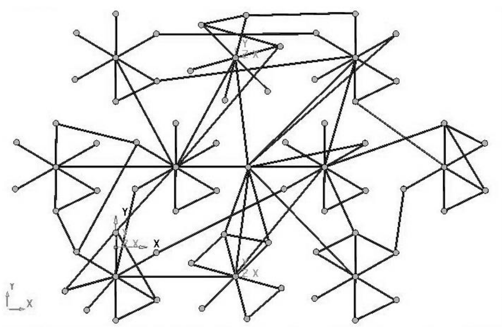

Fig.5. The sets of points and lines of communication

Actor of the Lace in a Comprehensive Network is a stem, stems attach the nodes of networks of different thematic layers (TL).

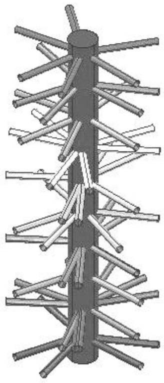

Fig.6. Lace actors in the CNL-trunks, stems attached network nodes different thematic layers (TL)

A classic graph has no two distinct edges connecting the same pair of vertices (nodes), in a Lace the number of links connecting a pair of stems might be multiple to the number of layers.

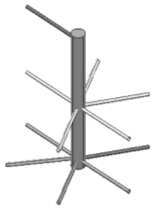

Fig.7. Thematic layers (TL) in the social system to determine the relations between family members, classmates, members of one the organization and department, superiors and subordinates-mi; colleagues in the same domain, and so on

Thematic layers in a social system are defined by relationships between:
1. relatives;
2. classmates;
3. employees of one organization and agencies, superiors and subordinates;
4. colleagues in one subject area;
5. neighbors and childhood friends;
6. countrymen;
7. coreligionists
8. friends on interests;
9. business partners;
10. random acquaintances.

Based on a Comprehensive Network Lace Scope in this work we propose a novel 3 Layer model of public connections for diverse State regimes for further simulation, quantitative assessment, and practical implementation in countering Global Disasters by international and interdisciplinary teams.

Principal findings and results

Based on a Comprehensive Network Lace Scope in this work we propose a novel 3 Layer model of public connections for diverse State regimes for further simulation, quantitative assessment, and practical implementation in countering Global Disasters by international and interdisciplinary teams.

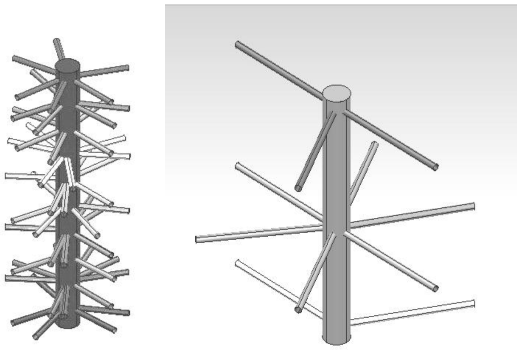

Fig.8. Third layer of government regulation

Traditionally the process of Emergency Management involves four phases: mitigation, preparedness, response, and recovery.

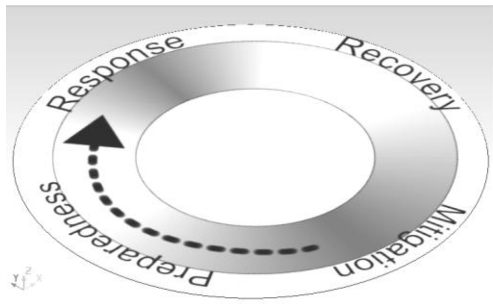

Fig.9. The process of disaster management

Contrary to known hierarchical layer application for Knowledge Acquisition and Information Sharing this new model describes an overall national Society Network by division that into the next three layers:

- Formal (State), as hierarchical governments structures
- Informal (presented by different long time sustainable link groups)
- Informal (acquaintances with short term links-so called weak ties)

The approach considers ambiguously communications between actors which are on different levels of hierarchy in a Comprehensive Network (eg information exchange, is modeled in several streams of information, formal and informal, from the more meaningful stem in a given hierarchy to peripheral one).

Summary

According to each of these layers – Severely State Formal, Sustainable Group Formal-Informal, and Severely Informal ones- we watch ONE of 3 types of Network topologies: hierarchical, scale –free, or random respectively.

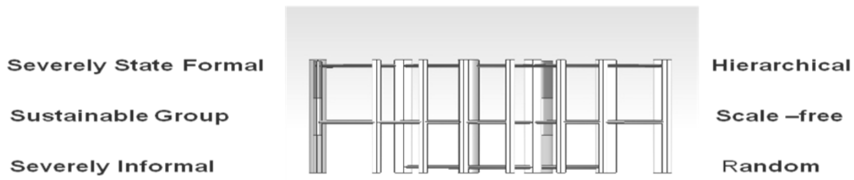

Fig.10. Three types of network topologies

Mapping brings the next of CNL illustrations in case of State power degradation.

Information exchange is supported by diverse links, formal and informal, for different power State status.

New metrics to assess an imbalance of formal and informal structures of social control, has been proposed:

1) M_c – moments of centralities for the node i and the centrality C (degree centrality, betweenness centrality, or closeness centrality):

$$M_{Ci} = (\sum_{j \neq i} C_j \cdot L_{ij}) / (n-1)$$

L_{ij} – the path length between nodes i and j, n – number of nodes (stems) in the network;

2) Nodes $I_{\min,C,t}$ of thematic layer t, for which the moment of centrality C have minimal value in the layer t;

3) Shift of t_2 in t_1:

$$S_{Ct1,t2} = (\sum_{jt2 \neq i} C_{jt2} \cdot L_{IminCt1,jt2}) / (n-1)$$

$L_{\text{Imin,Ct1,jt2}}$ is a path length between (a node for which the time of the centrality of C has a minimum value within layer t1) and jt2 (a node in layer t_2), t_1, $t_2 \in$ t;

4) Set (vector) of centralities for a stem: [C_d, C_b, C_c];

5) Set (vector) centrality moments for a stem: [M_{Cd}, M_{Cb}, M_{Cc}];

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