UDC 623.764

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INVESTIGATING NUCLEAR WAR DANGERS UNDER SPATIAL GRASP PARADIGM

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Анотація. *У статті описується застосування розробленої технології просторового захоплення (ТПЗ) для відображення складних структур-шаблонів міжнародних відносин, які можуть вказувати на ймовірність світових ядерних воєн. Ці активні рекурсивні шаблони на мові високого рівня можуть регулярно запускатися і просторово зіставлятися з будь-яких точок світу, що дозволяє досліджувати міжнародну безпеку ефективніше, ніж за допомогою інших методів. ТПЗ ґрунтується на баченні світу безпосередньо у вигляді інтегральних форм і структур у противагу традиційним моделям від частин до цілого. Її ключовим елементом є рекурсивна мова просторового захоплення (МПЗ), яка відображує розподілені простори і активність у них у вигляді, зрозумілому як для пілотованих, так і безпілотних компонентів. Просторові сценарії в МПЗ набагато компактніші, ніж в інших мовах, оскільки традиційні управлінські процедури ховаються в інтелектуальних, об'єднаних у мережі, інтерпретаторах МПЗ, уникаючи їх явного програмування. Це дозволяє задавати безпосередньо вищий рівень семантики того, що повинно бути зроблено (в економіці, промислових екосистемах, на полі бою, в роботизованих формуваннях, протиракетній обороні і т.д.) зі сценаріями МПЗ, які вільно і паралельно переміщуються у розподілених середовищах, забезпечуючи повний контроль над ними. Показуються різноманітність і складність існуючих міжнародних відносин, теперішнє розповсюдження ядерної зброї, пояснюються ключові особливості ТПЗ і МПЗ, а також наводяться приклади міжнародних схем і структур, які можуть потенційно привести до ядерної війни, з їх описом в МПЗ для глобального пошуку. Відзначається, що ТПЗ може ефективно перетворити увесь світ в інтелектуальний просторовий комп'ютер, який самостійно підтримує глобальну безпеку.*

Ключові слова: *світова динаміка, міжнародні відносини, ядерна зброя, всесвітні ядерні конфлікти, технологія просторового захоплення, розподілене інтерактивне моделювання.*

Аннотация. *В статье описывается применение разработанной технологии пространственного захвата (ТПЗ) для отображения сложных структур-шаблонов международных отношений, которые могут указывать на вероятность мировых ядерных войн. Эти рекурсивные шаблоны на языке высокого уровня могут регулярно запускаться и пространственно сопоставляться из любых точек мира, позволяя исследовать международную безопасность эффективнее, чем с помощью других подходов. ТПЗ основывается на видении мира непосредственно в виде интегральных форм и структур в противовес традиционным моделям от части к целому. Ее ключевым элементом является рекурсивный язык пространственного захвата (ЯПЗ), отображающий распределенные пространства и активность в них в виде, понятном как для пилотируемых, так и беспилотных компонентов. Пространственные сценарии в ЯПЗ намного компактнее, чем в других языках, поскольку традиционные управленческие процедуры упрятываются в интеллектуальные, объединенные в сеть интерпретаторы ЯПЗ, избегая их явного программирования. Это позволяет непосредственно задавать высший уровень семантики того, что должно быть сделано (в экономике, промышленных экосистемах, на поле боя, в роботизированных формированиях, противоракетной обороне и т.д.) со сценариями в ЯПЗ, свободно и параллельно перемещающимися в распределенных средах, обеспечивая полный контроль над ними. Показываются разнообразие и сложность существующих международных отношений, настоящее распространение ядерного оружия, объясняются ключевые особенности ТПЗ и ЯПЗ, приводятся примеры международных схем и структур, которые могут потенциально привести к ядерной войне, с их описанием в ЯПЗ для глобального поиска. Отмечается, что ТПЗ может эффективно превратить весь мир в интеллектуальный пространственный компьютер, самостоятельно поддерживающий глобальную безопасность.*

Ключевые слова: *мировая динамика, международные отношения, ядерное оружие, всемирные ядерные конфликты, технология пространственного захвата, распределенное интерактивное моделирование.*

Abstract. *The paper describes applicability of the developed Spatial Grasp Technology (SGT) for describing patterns of international relations that can hint on probability of nuclear wars, while applying them worldwide in parallel and distributed mode. These recursive patterns in high-level language can be regularly launched and spatially matched from any world points, allowing us to investigate world security more efficiently than in a traditional centralised way. SGT is ideologically based on quite different, holistic, world vision directly as integral shapes and patterns rather than traditional parts-to-whole models. Its key element is high-level recursive Spatial Grasp Language (SGL) which can express distributed spaces and operations in them in a way understandable to both manned and unmanned components. The spatial scenarios in SGL are much shorter than in other programming languages as the approach effectively hides most of traditional system management routines into intelligent interpreters of SGL, which can be networked worldwide, thus avoiding their explicit programming. This allows us to grasp top semantics of what to be done (in economy, industrial ecosystems, battlefields, robotic swarms, missile defence, etc.) at runtime and ahead of it, with SGL scenarios freely moving, modifying and replicating in distributed environments while keeping full control over distributed physical, virtual or combined spaces. The paper shows diversity and complexity of international relations, current world distribution of nuclear weapons, explains key features of SGT and SGL, also provides examples of international patterns that can potentially lead to nuclear war, with their implementation in SGL and worldwide search. SGT can effectively convert the whole world into an intelligent spatial computer self-supporting global security.*
Keywords: *world dynamics, international relations, nuclear weapons, world nuclear conflicts, Spatial Grasp Technology, distributed interactive simulation.*

1. Introduction

Nuclear weapons are important for a number of reasons, including their role in deterrence, national prestige, and military budgets [1]. But underlying all this is the possibility that they could be used in war, and a nuclear war would be catastrophic and even suicidal. Avoiding nuclear war is thus a topmost priority for the international community. In [2], after analysing the years after WW2, three pathways to nuclear war were explored: an international crisis leading directly to nuclear war, an accident or misperception leading to nuclear escalation or nuclear retaliation against an imaginary attack, and a general conventional war leading to nuclear war. The detailed assessment has found that the expected probability of nuclear war during this historical period was greater than 50 percent! This level of risk is extremely high. It is therefore urgent that effective measures be taken to substantially reduce the risk of nuclear war. The current paper shows how to find in a multitude, diversity, and high dynamics of international relations the worldwide appearance of particular spatial patterns that can potentially lead to a nuclear war, by using the invented, developed, and tested high-level holistic distributed control ideology and technology.

The rest of this paper is organized as follows. Section 2 shows how complex international relations can be, and how important is to predict and prevent conflicts between countries and the world as a whole, especially with the nuclear weapons accumulated worldwide. Section 3 briefs main ideas and key features of SGT and SGL with elementary examples of programming in the latter, as well as how distributed networked SGL interpreter is organized. In section 4, we are demonstrating how possible patterns of relations between different countries, which can potentially lead to nuclear conflicts, can be converted into active patterns-scenarios in SGL regularly self-matching in parallel and fully distributed mode with worldwide international structures, in order to find related emerging threats. Section 5 concludes the paper, also sharing plans on the use of SGT in another area related to nuclear conflicts – like their distributed interactive simulation, especially using experience from previous technology versions engaged in simulation of military systems.

2. International Conflicts and Their Probabilities

In this section we will show how complex international relations can be and how important is to predict and prevent conflicts between countries and the world as a whole, especially with the huge amounts of nuclear weapons accumulated worldwide.

2.1. Complexity of Relations between Different Countries

We are often confused about what's really happening in the Middle East. The interactive diagram of Fig. 1 (taken from [3]) sums up the geopolitical alliances traversing this ancient region. The diagram clearly maps out the relationships between the main players as well as external powers that are deeply involved in the region. The relationships follow logical patterns reflecting geopolitical interests, partnerships, and conflicts. Every player in the region has interests that intersect and sometimes collide with enemies and allies alike, and the diagram illustrates the region's alliances and hatreds. We are shown this without further details, only as an example that even with limited number of nodes-countries but with their numerous diverse relations looks like a «hairball», with hrs to investigate it using conventional screening and centralised computer analysis. A more detailed and extended diagram related to the same world's region can be found in [4].

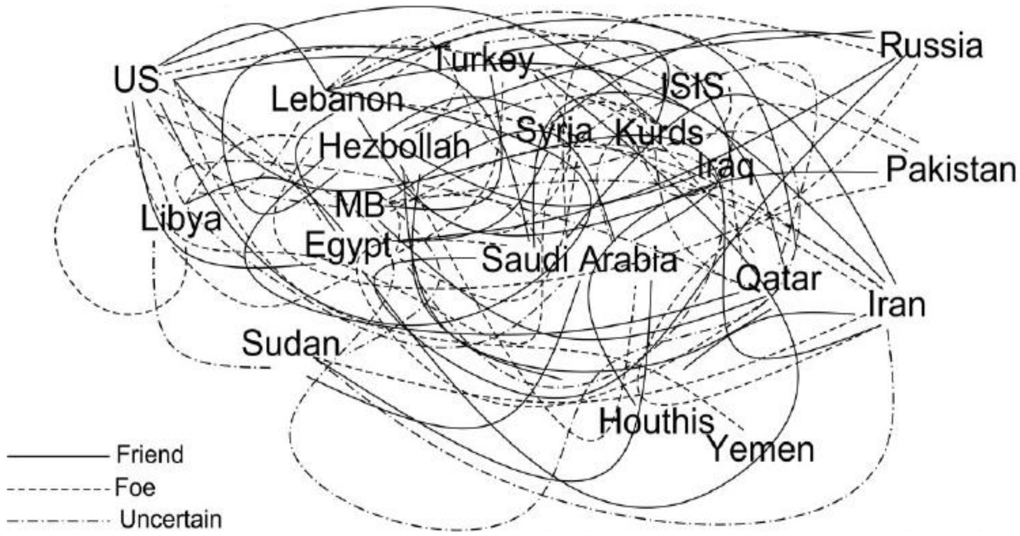


Figure 1 – Diagram of geopolitical relationships in the Middle East, 2015

2.2. The World Nuclear Powers

The danger and possibility of global world conflicts is especially aggravated by the existence of nuclear weapons which are possessed by eight states as in Fig. 2 (see also [5]) with shown estimated number of nuclear weapons in them. The «official» nuclear-weapon states (NWS) are the five states – China, France, Russia, United Kingdom, and the United States – recognized as possessing nuclear weapons by the nuclear Nonproliferation Treaty (NPT) [6]. The treaty legitimizes these states' nuclear arsenals, but establishes they are not supposed to build and maintain such weapons in perpetuity. The world's nuclear-armed states possess a combined total of roughly 15,000 nuclear warheads; more than 90 percent belong to Russia and the United States. Approximately 9,600 warheads are in military service, with the rest awaiting dismantlement.

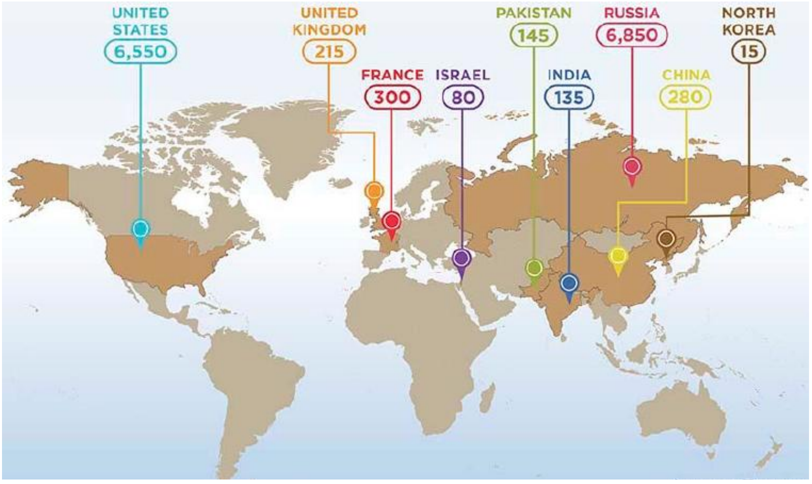


Figure 2 – 2018 estimated global nuclear warhead inventories

2.3. Probabilities of Nuclear War

The probability of nuclear war is a major factor in many important policy questions [7]. A world nuclear war is one that can involve most or all nuclear powers releasing a large proportion of their nuclear weapons at targets in nuclear and perhaps non-nuclear states. Such a war could be initiated accidentally, aggressively or pre-emptively and could continue and spread through these means or by retaliation by a party attacked by nuclear weapons. Such a war could start through a reaction to terrorist attacks, or through the need to protect against overwhelming military opposition, or through the use of small battle field tactical nuclear weapons meant to destroy hardened targets, and after that quickly moving to the use of strategic nuclear weapons. In Fig. 3 are shown a few hypothetical scenarios from [8] by which world nuclear war could come about. We are copying these fantasised pictures only to show possible spatial dynamics and territory coverage of such types of conflicts, which can potentially involve the whole globe. Different arrow colours express different types of attacks: red – aggressive, yellow – pre-emptive, blue – retaliatory, and green – accidental.

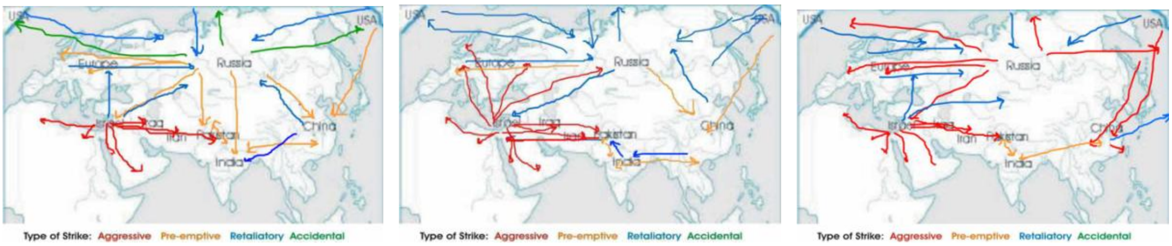


Figure 3 – Some 2007 escalation scenarios spiralling to world nuclear war

The paper [1] aims at developing a model for calculating the total probability of nuclear war. The core of the paper is a model covering 14 scenarios for how nuclear war could occur. Scenarios vary based on factors including whether a state intends to make a first strike attack, whether the nuclear attack is preceded by a conventional war or a non-war crisis, whether escalation is intentional or inadvertent, the presence of false alarms of various types, and the presence of non-war nuclear detonations such as nuclear terrorism. In 6 scenarios, a state intentionally starts nuclear war. In the other 8, a state mistakenly believes it is under nuclear attack by another state and starts nuclear war in what it believes is retaliation. The model is supplemented with a dataset of 60 historical incidents that may have threatened nuclear war. The paper also includes extensive background on probability theory and nuclear war probability analysis.

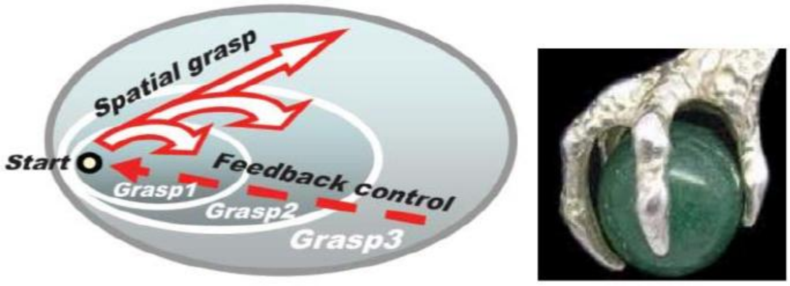
In the next section we will be describing a high-level distributed control technology suitable for dealing with the problems discussed.

3. Spatial Grasp Technology

Were are showing here only main ideas and key features of this paradigm developed and tested in different countries, with its details and numerous application examples fully available in the existing publications, [9–15] including.

3.1. SGT Model

Within SGT, a high-level scenario for any task to be performed in a distributed world is represented as an active self-evolving pattern rather than traditional program, sequential or parallel. This pattern, written in a high-level Spatial Grasp Language (SGL) and expressing top semantics of the problem to be solved, can start from any world point. It then spatially propagates, replicates, modifies, and matches the distributed world, as shown in Fig. 4 a, b.



a b

Figure 4 – The basic idea of SGT: a) controlled parallel wavefront space navigation;
b) symbolic physical equivalent

3.2. SGL Recursive Structure

SGL allows us to directly move through, observe, and provide any actions and decisions in fully distributed environments (whether physical, virtual, executive or combined). It has universal recursive structure, as shown below, capable of representing any parallel and distributed algorithms operating on, over or in spatially scattered data or other distributed systems.

grasp → *constant* | *variable* | *rule* [({ ***grasp*****,** })]
constant → *information* | *matter* | *custom* | *special* | ***grasp***
variable → *global* | *heritable* | *frontal* | *nodal* | *environmental*
rule → *type* | *usage* | *movement* | *creation* | *echoing* |
verification | *assignment* | *advancement* | *branching* |
transference | *exchange* | *timing* | *qualifying* | ***grasp***

3.3. Spatial Development of SGT Scenarios

An SGL scenario (or *grasp*) develops as parallel transition between sets of progress points (or *props*), with self-modified and self-replicating scenario code freely moving in distributed spaces. Starting from a prop, an action may result in new props (which may be multiple). Elementary operations can directly use states and values of props reached by other actions whatever complex and remote they might be. Any prop can associate with a position in physical, virtual, executive or combined world. Staying with world points, it is possible to directly access and impact local world parameters in them. Overall organization and control of the breadth and depth space navigation and coverage is provided by SGL rules which may be arbitrarily nested.

3.4. SGT Spatial Variables

Working in fully distributed physical, virtual or executive environments, SGL has different types of variables, called spatial, which are effectively serving multiple cooperative processes: global variable – most expensive and rarely used as needing a sort of centralization of certain resources; heritable variables – starting in a prop and serving all subsequent props which can share them in both read & write operations; frontal variables – transferred on wavefronts between consecutive props and replicated if multiple new props emerge; environmental variables – accessing different elements of physical and virtual words when navigating them, also certain parameters of SGL interpreter; and nodal variables – a temporary property of world nodes accessed and shared by all activities which happened to be associated with them at the same or different times.

3.5. SGL Networked Interpreter

The SGL interpreter (stemming from [11]) consists of a number of specialized modules handling and sharing specific data structures. The interpreter copies can communicate with each other, and their distributed network can be mobile and open, changing the number of nodes and communication structure at runtime. The backbone and nerve system of the distributed interpreter is its dynamic spatial track system with its parts kept in a special memory of local interpreters. These are logically interlinked with similar parts in other interpreter copies while providing altogether global control coverage. The distributed track structure enables for hierarchical and horizontal control, also remote data and code access, with high integrity of emerging parallel and distributed solutions.

3.6. Creating Spatial Infrastructures under SGT

The self-spreading & matching patterns can create knowledge infrastructures arbitrarily distributed between system components with embedded SGL interpreters, which may spread worldwide, as in Fig. 5. These infrastructures, which may be left active, can effectively support or express distributed databases, command and control, situation awareness, autonomous decisions, as well as any other existing or hypothetical computational and control models. They can, for example, be a result of spatial matching of graph-based parallel patterns of any complexity expressed in the SGL recursive syntax.

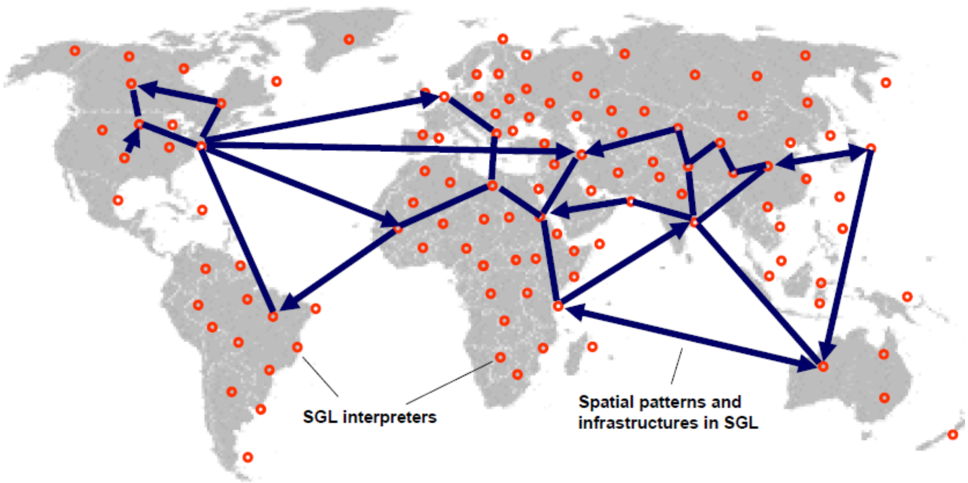


Figure 5 – Spatial patterns and infrastructures in SGL

3.7. Elementary Programming Examples in SGL

We are showing here only elementary examples of programming in SGL, where many more can be found elsewhere, incl. [8–14].

(a) Assignment of the sum of values 15, 22 and 14.7 to the variable Result.

```
assign(Result, add(15, 22, 14.7))
```

(b) Moving physically from the current location independently and simultaneously to new locations (x2, y7) and (x4, y9).

```
move(x2, y7), move(x4, y9)
```

(c) Creating isolated virtual node John:

```
create(node(John))
```

(d) Extending the virtual network (already having node John) with new link-node pair like «John is father of Bob».

```
hop(John); create(+father, Bob)
```

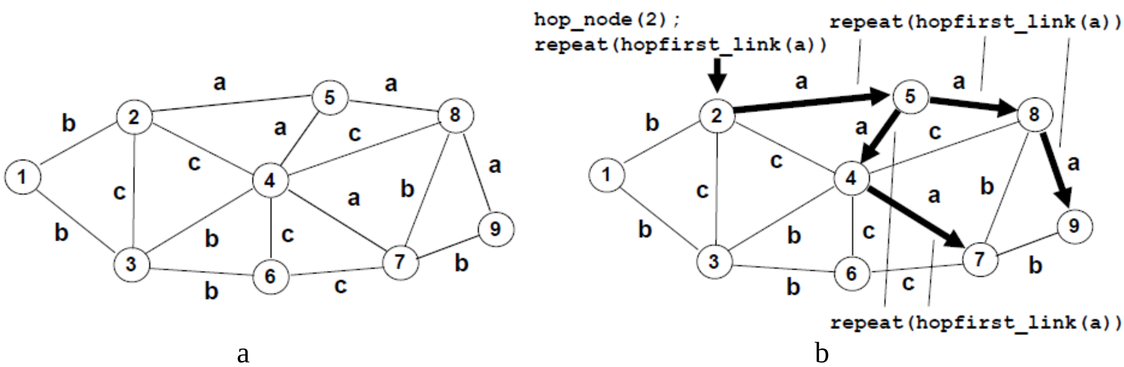
(d) Ordering soldier Nick to use robot Fighter to fire by coordinates (x, y) with confirmation of success or failure of this operation.

```
hop(Nick);
report_if((hop(Fighter); fire(x, y)), success, failure)
```

(e) Starting in node 2 of a network, repeatedly propagate through all adjacent links named a as far as possible

```
hop_node(2);
repeat(hopfirst_links(a))
```

For the network of Fig. 6 a we will have its spatial navigation as shown in Fig. 6 b, which develops in both sequential and parallel mode while blocking looping to the already visited nodes (rule hopfirst rather than just hop used). After application in node 2 the SGL scenario omits utilized first part and then self-spreads through network links named a while replicating and parallelising in node 5.



a b

Figure 6 – Repeated network navigation with self-spreading-parallelizing SGL scenario

If we may want to return and print names of final nodes reached, the modified scenario will be as follows:

```
output(
  hop_node(2);
  repeat(hopfirst_links(a)); NAME)
```

Returned and printed result: 7, 9.

As shown by the above examples, SGL directly operates with physical, virtual, executive and just computational environments, which allows us to use the same language for most diverse operations and at different levels in distributed system management.

4. Representing of World Nuclear Danger Patterns in SGL

In this section we will be demonstrating some simple patterns of relations between different countries that can potentially lead to nuclear conflicts, composing corresponding active scenarios in SGL that can self-match with international organizational structures for finding emerging threats.

4.1. A 3-Node Danger Pattern

Imagine a nuclear country (let it be COUNTRY_1) is at_war with some other country (as non-nuclear) which is its neighbour (say, COUNTRY_2), and the latter is in close relation with some other nuclear country (like COUNTRY_3) which serves as its political and economic sponsor. The situation also aggravates by the fact that COUNTRY_1 and COUNTRY_3 are bitter rivals and in bad relations.

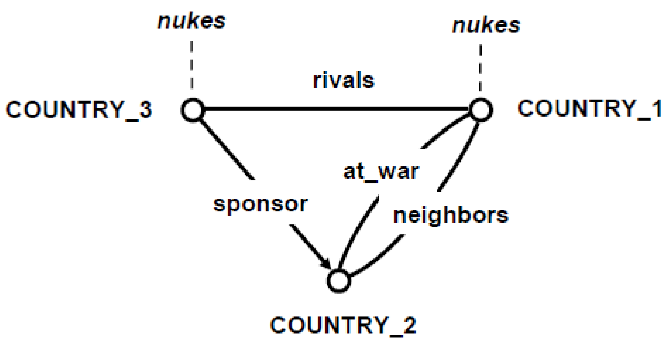


Figure 7 – A simple 3-node danger pattern

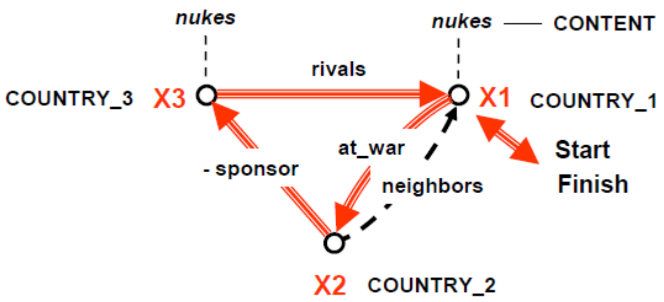


Figure 8 – Representing the 3-node pattern by a path through all nodes

To find all matching of this pattern worldwide with all countries and their numerous relations we have to convert this passive pattern into an active self-matching one expressed in SGL. This active pattern can be composed by considering a path through all pattern nodes (many such techniques can be found in [12–15]) and starting, for example, from node COUNTRY_1. It will also be associating spatial variables (like X1, X2, and X3) with its nodes, as in Fig. 8 and the SGL scenario that follows (second relation, as neighbours, between the first two nodes should be taken into account too).

```
hop_nodes(all); belong(nukes, CONTENT);
frontal(X1, X2, X3); X1 = NAME;
hop_link(+ at_war); notbelong(nukes, CONTENT);
yes(hop(link(neighbors), node(X1))); X2 = NAME;
hop_link(- sponsor); belong(nukes, CONTENT); X3 = NAME;
hop(link(rivals), node(X1));
output('Danger: ', X1, X2, X3)
```

This pattern-scenario starting in all nuclear nodes-countries in parallel will move stepwise through the given links while collecting the passed node names in three mentioned frontal variables X1-X3, with making output after (and if) returning to the node from which it started (i.e. with its name in X1), as follows.

```
Danger: COUNTRY_1, COUNTRY_2, COUNTRY_3
```

If more than one pattern match occurs (like starting from different nukes-capable nodes or different X3-related nodes occurred while starting from the same X1-based node), it may be multiple outputs of solutions in the same or different nodes relating to X1.

```
Danger: COUNTRY_1, COUNTRY_2, COUNTRY_3
...
Danger: COUNTRY_1n, COUNTRY_2n, COUNTRY_3n
```

We can easily collect all such solutions in one point if needed, say, in the location from which the whole scenario was initially launched, also repeat the scenario indefinitely with certain delay between repetitions, as follows (the relations between countries may change for different repetitions and delays):

```
loop(
  Solutions =
     (hop_nodes(all); belong(nukes, CONTENT);
      frontal(X1, X2, X3); X1 = NAME;
      hop_link(+ at_war); notbelong(nukes, CONTENT);
      yes(hop(link(neighbors), node(X1))); X2 = NAME;
      hop_link(- sponsor); belong(nukes, CONTENT); X3 = NAME;
      hop(link(rivals), node(X1));
      unit(X1, X2, X3));
  if(nonempty(Solutions), output('Dangers: ', Solutions));
  sleep(delay))
```

The output in this starting location integrating all possible matching of this pattern throughout the whole world may be as follows for each repetition (possibly, with changing country names or none if no matching found at this moment of time).

```
Dangers: (COUNTRY_1, COUNTRY_2, COUNTRY_3),
         ...
         (COUNTRY_1n, COUNTRY_2n, COUNTRY_3n)
```

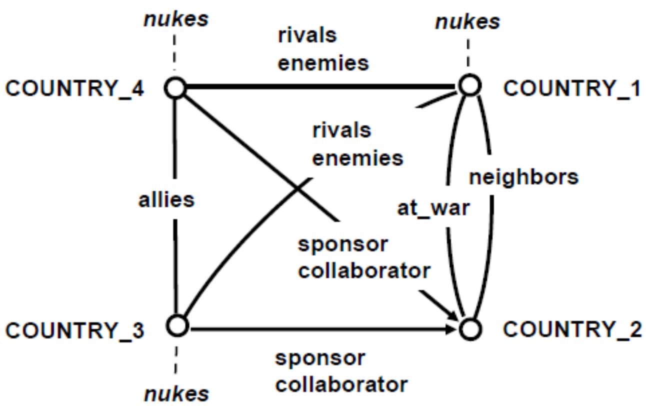


Figure 9 – A 4-node danger pattern

4.2. A More Complex 4-Node Danger Pattern

Let us consider a bit more complex pattern of relations between countries, shown in Fig. 9, where one more nuclear-capable COUNTRY_4 can be engaged, having similar relations with COUNTRY_1 (as rivals or enemies) and COUNTRY_2 (as sponsor or collaborator).

An active scenario-pattern for this set of inter-node relations can also be based on path through all its nodes as in

Fig. 10, with corresponding SGL scenario shown below (regularly launching in parallel all possible matching with returning and printing all results in the scenario launching position, as we finally did for the three-node pattern before).

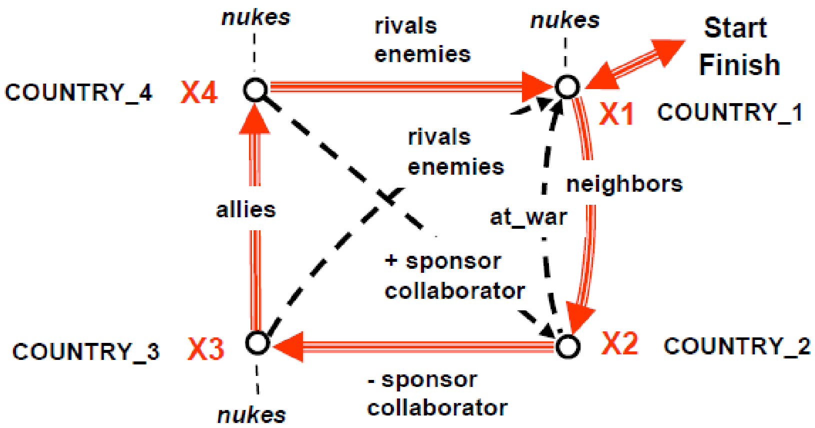


Figure 10 – Representing the 4-node pattern by a path through all nodes

```
loop(
  Solutions =
    (hop_nodes(all); belong(nukes, CONTENT);
     frontal(X1, X2, X3, X4); X1 = NAME;
     hop_link(neighbors); notbelong(nukes, CONTENT);
     yes(hop(link(at_war); node(X1))); X2 = NAME;
     hop_link(- sponsor, collaborator); belong(nukes, CONTENT);
     yes(hop(link(rivals, enemies); node(X1))); X3 = NAME;
     hop_link(allies); belong(nukes, CONTENT);
     yes(hop(link(+ sponsor, collaborator); node(X2))); X4 = NAME;
     hop(link(rivals, enemies), node(X1));
     unit(X1, X2, X3, X4));
  if(nonempty(Solutions), output('Dangers: ', Solutions));
  sleep(delay))
```

The regular output in the scenario starting location will be similar to the previous three-node pattern example (with possibly changing country names or resulting completely in none too for different repetitions):

```
Dangers: (COUNTRY_1, COUNTRY_2, COUNTRY_3, COUNTRY_4),
         ...
         (COUNTRY_1n, COUNTRY_2n, COUNTRY_3n, COUNTRY_4n)
```

4.3. A Danger Pattern with Multiple Nodes

Let us consider a more general case with more (actually any number of) countries having sponsor or collaborator links with COUNTRY_2 and being in rivals or enemies relations with COUNTRY_1, wile in allies relationship in between, thus resulting in the whole varying structure and size pattern as in Fig. 11.

For producing the relevant active search pattern we will be again using a path through all nodes of the original pattern, as in Fig. 12 and the SGL scenario that follows (where each new node to be included into Others must have links allies to all previous nodes in Others, also similar relations with nodes by X1 and X2).

ISSN 1028-9763. Математичні машини і системи, 2019, № 2

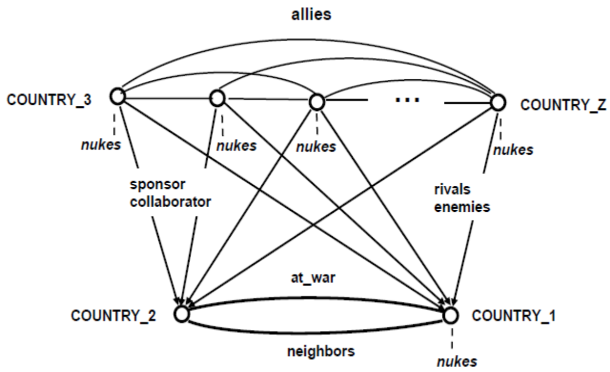


Figure 11 – Multiple nodes danger pattern

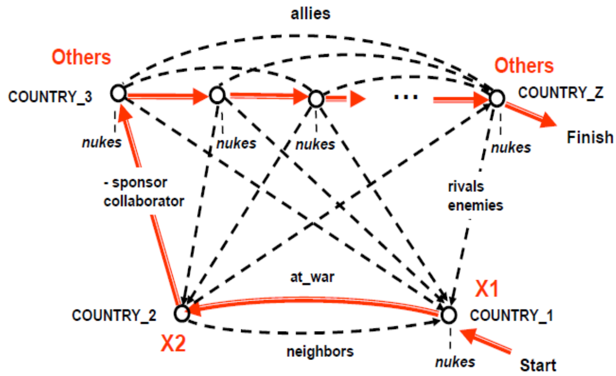


Figure 12 – Sequential-parallel representation of the multiple nodes pattern

```
loop(
  Solutions =
    (hop_nodes(all); belong(nukes, CONTENT);
     frontal(X1, X2, Others); X1 = NAME;
     hop_link(at_war); notbelong(nukes, CONTENT);
     yes(hop(link(neighbors); node(PREDECESSOR))); X2 = NAME;
     hop_link(- sponsor, collaborator); belong(nukes, CONTENT);
     yes(hop(link(rivals, enemies); node(X1))); Others = NAME;
     repeat(
        hop_link(allies); belong(nukes, CONTENT);
        yes(hop(link(rivals, enemies); node(X1)));
        yes(hop(link(+ sponsor, collaborator); node(X2)));
        yes(and_parallel(hop(link(allies), nodes(Others))));
        append(Others, NAME));
     unit(X1, X2, Others));
  if(nonempty(Solutions), output('Dangers: ', Solutions));
  sleep(delay))
```

The regular output in the scenario starting location (which may be any institution or place in the world, UN Headquarters including) will be similar to the previous three and four node patterns:

```
Dangers: (COUNTRY_1, COUNTRY_2, COUNTRY_3),
         (COUNTRY_11, COUNTRY_21, COUNTRY_31, COUNTRY_41),
         ...
         (COUNTRY_1n, COUNTRY_2n, COUNTRY_3n, …, COUNTRY_Zn)
```

The matching solutions can spread worldwide, with a hypothetical one shown in Fig. 13, where very different countries can potentially be covered by the patterns discussed.

Figure 13 – A possible worldwide match by the discussed patterns

In further scenario developments, we may take into account how powerful COUNTRY_1 is (say, by its number of nukes), also what is the summary power registered in Others (like total number of their nukes too), also the importance of COUNTRY_2 (like strategic location, population, GDP, political system, etc.). In other extensions may be more than a single COUNTRY_2 with similar relations to COUNTRY_1 and those in Others.

Much more diverse and detailed patterns and scenarios, with nodes not only being the whole countries but their regions or various institutions as well (like economic, political, cultural or religious groupings, etc.) can be effectively composed and applied worldwide. Very different scenarios can be integrated in SGL into larger scenarios, say, with many alternatives and probabilities, also without any limitations on number of their nodes and relations between them. All such scenarios can be applied regularly, any time, and from any world points, finding both local and global solutions in parallel and fully distributed mode, without any central resources.

5. Conclusions

We have considered the capability of SGT for worldwide matching of different nuclear war danger patterns with distributed international structures. The solutions can be found in a fully distributed way, without any central resources, with absolute spatial mobility of recursive scenarios in SGL. Communicating SGL interpreters can be massively installed worldwide while integrating with existing systems, media ones incl., in thousands to millions to billons of copies, effectively converting the whole world into intelligent spatial machine that can self-analyse the world's state, discover and prevent local and global dangers, and collectively recover from world crises. Another, related, application area for this paradigm may be distributed simulation (also dealing in reality) of the already emerging world conflicts, nuclear ones including, like in [8], which is planned in the subsequent papers and new book on international security which is currently in progress. Also worth mentioning here that previous versions of SGT (called WAVE) were efficiently used for similar tasks, especially for distributed interactive simulation of large military systems [16–19].

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Стаття надійшла до редакції 08.04.2010