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Spatial Management of Multidimensional International World

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“Multidimensional international world” refers to understanding the world through its multiple dimensions beyond traditional economic or political measures, by fostering cross-cultural collaboration and balancing global integration with local needs. The paper briefs the developed high-level Spatial Grasp Model and Technology (SGT) which can investigate and manage complex systems with a holistic spatial approach effectively covering different physical and virtual dimensions and their integration as a whole. It then describes basics of multidimensional management system which is currently under development, and provides examples of practical solutions in different dimensions and their combinations in Spatial Grasp Language (SGL), the key element of SGT, with networking representations of the solutions. These include inter-dimensional influence and optimization, finding multidimensional communities, showing multidimensional recovery after disasters, finding dangerous multidimensional groupings, isolated multidimensional components, as well as interaction of physical and virtual dimensions. Different versions of SGT were tested on numerous applications and in different countries, and its latest version, especially suitable for multidimensional management, can be quickly implemented on any existing software or hardware platforms an integrated with advanced communication systems.

Keywords: multidimensional world, Spatial Grasp Technology, Spatial Grasp Language, distributed network operations, dimensions investigation and management, collective multidimensional solutions, global integrity

1. Introduction

The word “multidimensional” in relation to human societies may have different expressions and meanings, including the following. *Multidimensional society* is one that recognizes and analyzes complex issues through multiple perspectives, rather than a single-factor view (Kranzberg, 1970). *Multidimensional international relations* recognizes that global interactions involve diverse facets beyond politics and war, encompassing economic, cultural, technological, legal, social, and environmental dimensions (Shehu, 2024). *Multidimensional diplomacy* means that states often negotiate with each other over more than one issue at the same time, and can send signals about their resolve that have dramatic effects on other states' beliefs and actions (Trager, 2011). *Managing international multidimensional worlds* involves navigating of complex factors that impact multinational corporations, virtual teams, and global supply chains (Medium.com, 2022).

We researched, and analyzed in detail many existing publications on different world dimensions, which include the following: *Political dimension* (Dennana.in, 2024a; Mail.google.com, n.d.; Researchgate.net, 2023a; Researchgate.net, 2023b), *Economic dimension* (Sanders, 1989; Wikipedia, n.d.; Sidenko, 2004; Researchgate.net, 2022), *Security dimension* (Gasteyger, 1985; Mahabbat, 2024; Ganesh, 2025; Pawlak, 2025), *Legal dimension*

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(Manton, 2018; Zabara, 2017; Murphy, 2012; Researchgate.net, 2023c), *Cultural and social dimension* (Manton, 2018; Zabara, 2017; Murphy, 2012), and *Technological dimension* (Dennana.in, 2024b; Narula & Zanfei, 2003; Farahat, 2001; Gui, Liu, & Du, 2019), and others.

The aim of this paper is to review and explain how distributed international world is organized as a set of interacting dimensions, and investigate potential and practical applicability of the developed Spatial Grasp Model and Technology (SGT) for effective management of large and complex multidimensional systems.

The rest of the paper provides the following: Reviews basics of SGT and their distributed implementation (Section 2); Describes basics of multidimensional management system which is currently under development (Section 3); Provides example of inter-dimensional influence and optimization (Section 4); Describes finding multidimensional communities (Section 5); Shows multidimensional recovery after disaster (Section 6); Hints how to find dangerous multidimensional viral or mental groupings (Section 7); Discovers isolated multidimensional nodes and groups (Section 8); Describes interaction of physical and virtual dimensions (Section 9). Section 10 concludes the paper, with References citing the used publications.

2. Spatial Grasp Model and Technology Summary

Within Spatial Grasp Model and Technology (SGT) (Sapaty, 1993; 1999; 2005; 2017; 2018; 2019; 2021; 2022; 2023; 2024a; 2024b; 2025a; 2025b; 2025c; 2025d; 2025e), a high-level operational scenario expressed in recursive Spatial Grasp Language (SGL), starting in any world point or points, *propagates, covers, and matches the distributed environment in parallel wavelike mode*, as symbolically shown in Figure 1. Such propagation can result in returning and analyzing the reached states and data, which may be arbitrarily remote, or to be used for launching more waves, also jointly in both cases.

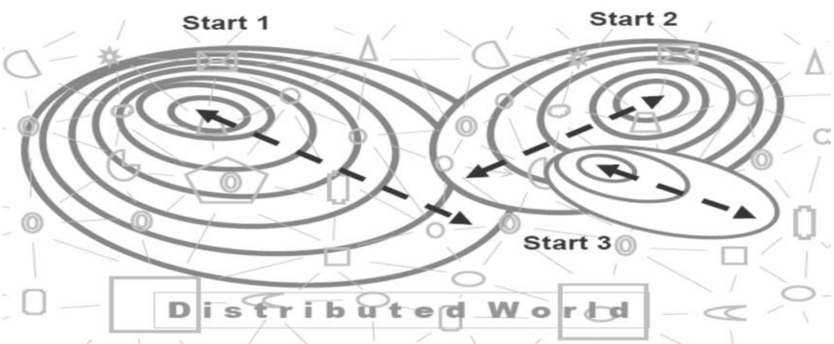


Figure 1. Parallel recursive world coverage with Spatial Grasp Model.

The distributed worlds this model effectively covers, conquers, and manages may be of different types: *Physical World (PW)*, *Virtual World (VW)*, and *Executive World (EW)*. Different combinations of these worlds can also be possible within the same formalism.

The Spatial Grasp Language (SGL), as basics of SGT, allows for direct space presence and operations with unlimited powers and parallelism. Its top level universal recursive organization, with operational scenarios called *grasps*, can be expressed as follows:

grasp → *constant* | *variable* | *rule* ({ *grasp*, })

constant → *information* | *matter* | *custom* | *special*

variable → *global* | *heritable* | *frontal* | *nodal* | *environmental*

rule → *type* | *usage* | *movement* | *creation* | *echoing* |

verification | *assignment* | *advancement* | *branching* |
transference | *exchange* | *timing* | *qualifying*

The SGL rules, starting in certain points, can organize navigation of the world sequentially, in parallel, or any combinations thereof. They can result in the same application points or cause movement to other points with obtained results left there or returned. The final points can become starting ones for other rules. The rules, due to recursive language organization, can form arbitrary operational infrastructures expressing sequential, parallel, hierarchical up to fully decentralized and distributed algorithms.

Communicating SGL interpreters can be in arbitrary number of copies effectively integrated with other existing systems and communications, representing altogether *powerful spatial engines* operating without central resources or control.

3. Multidimensional Management System

The general view of this project organization is depicted in Figure 2, which consists of overlaying and communicating spatial dimensions, and Global Management (GM) system allowing for entering, analyzing, and optimizing different dimensions and their interactions as the unified whole.

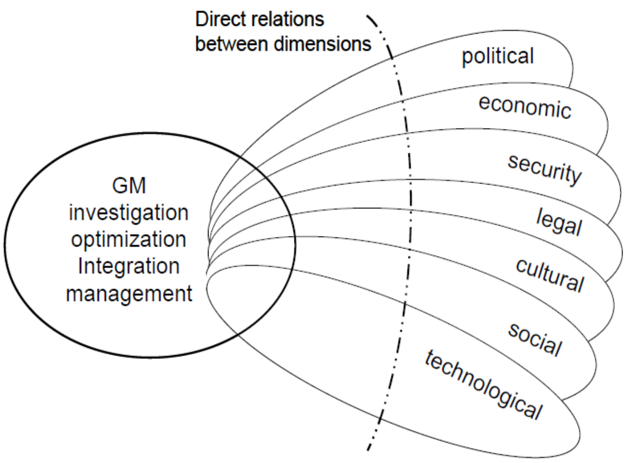


Figure 2. Multidimensional management system.

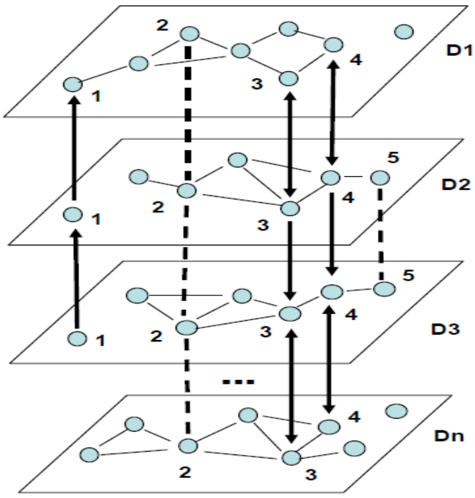


Figure 3. Interactions between dimensions.

Figure 3 shows some ideas of how different dimensions can be organized and interconnected, with direct contacts of versions of the same nodes in different dimensions. The directed arrows between node versions reflect superiority or equivalence of same named nodes in multidimensional integrity. Dashed non-oriented links show that all versions are equivalent throughout the multidimensional system. In each dimension different nodes may form arbitrary complex networks reflecting its type, ideology and operation, which may depend on interactions with nodes in other dimensions, especially same named ones. Types of relations between nodes in different dimensions many be unique for these dimensions.

The following examples show how to enter different dimensions, solve problems in them, and how to move between dimensions. Entering any dimensions from GM by operation enter, reaching certain points there and organize operations from them may look follows:

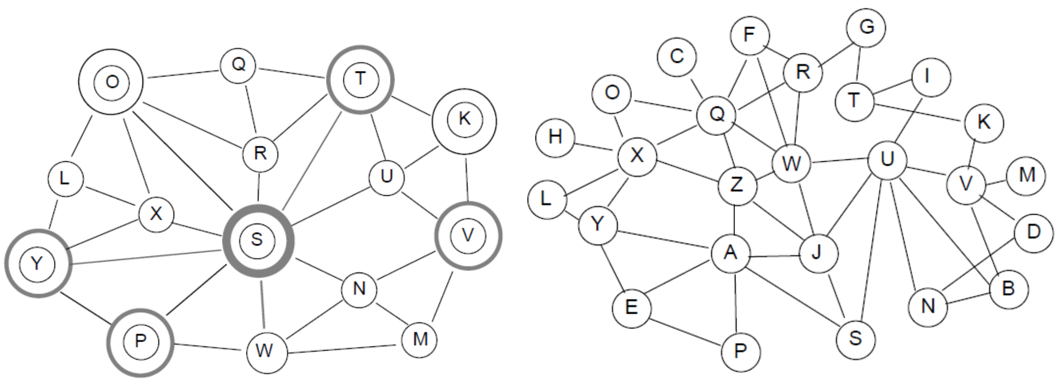
enter(Political, Economic, ...); hop(name_1, ..., name_n); <operate>

Also, when staying in a node in some dimension, you can directly slide into the same named node (or nodes) in other dimensions (if such exist) and continue operate there, thus avoiding the use of GM by special operation shift, like:

<staying in a node>; shift(Economic, Technological, ...); <operate>

4. Example of Inter-dimensional Influence and Optimization

We will consider here how the findings in one dimension can influence a solution in other dimension, considering for this a possible interplay of political and economic dimensions symbolically shown in Figure 4.



(a) Economic network (b) Political network

Figure 4. Economic and political network examples.

Let us first find most powerful economic countries using network example of Figure 4a, which symbolically reflects economic powers of different countries by sizes of the respecting nodes, taking into account that the countries of interest should have personal economic POWER exceeding some threshold. Initially staying in GM, entering the economic dimension with the registered countries-nodes in it, and then returning to GM the needed node names in the variable Nodes, may look like follows:

Nodes = (enter(Economic); hop(nodes); POWER > *threshold*; NAME)

Having received the list of names of powerful economic nodes like S, T, V, Y and P of Figure 4a, we can try now to add economic-political relations between all same named nodes within the political dimension network of Figure 4b, with the result (in dotted links) shown in Figure 5. This is in hope that such new links may be useful for developing both economic and political cooperation between these countries, thus benefitting the global development and prosperity.

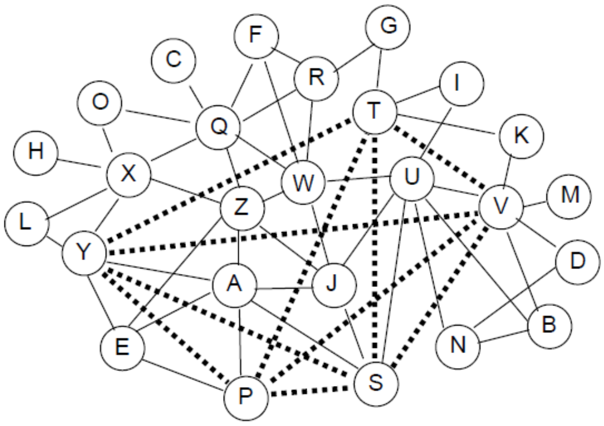


Figure 5. Adding new relations in the political network.

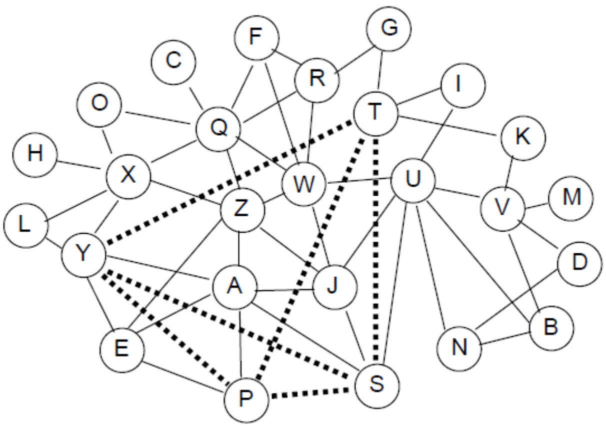


Figure 6. Solution 2.

The full solution involving the sequence of operations in both dimensions will be as follows, with `ecopol` as the name of new economic-political relations in the political network:

frontal(Nodes) = (enter(economic);

hop(all_nodes); POWER >= *threshold*; NAME);

eneter(political); hop(Nodes); split(Nodes);

if(NAME > VALUE, linkup(ecopol, node(VALUE)))

Modification of this decision may be to interlink nodes only if they are all directly interconnected in the economic network, thus excluding from consideration node V not having direct links with S, T, Y, and P, as in Figure 4a. The updated and interlinked set of nodes can be received by the following updated procedure. The obtained solution, or Solution 2, will be as shown in Figure 6.

enter(economic);

frontal(Nodes) = (hop(all_nodes); POWER >= *threshold*; NAME);

Nodes = (hop(Nodes); if(hop(link, Nodes), NAME));

enter(political); hop(Nodes); split(Nodes);

if(NAME > VALUE, linkup(ecopol, node(VALUE)))

More dimensions may need being considered for this solution, rather than just two, including others like cultural, legal, security, technology, defense, etc. Otherwise, it may happen not so useful for the global system, and could potentially lead to problems or even conflicts. Further modification of Solution 2 may be by additionally considering the defense dimension, which can contain different and potentially conflicting security blocks Bi, as in Figure 7. In this respect, the solution may be further modified by interconnecting only nodes from the same security block or from no blocks at all. So, the next Solution 3 can only include nodes T, Y of B1 and node S not registered in any blocks, as shown in Figure 8. Its expression in SGL may be as follows.

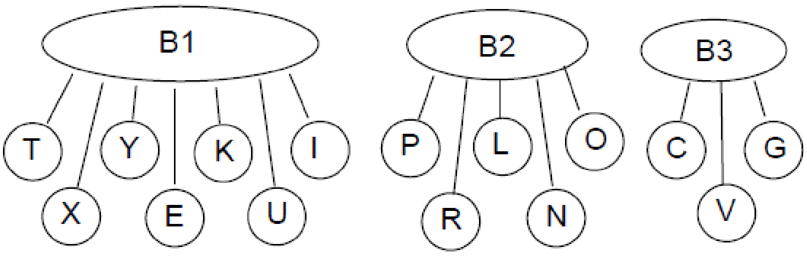


Figure 7. Military-security blocks.

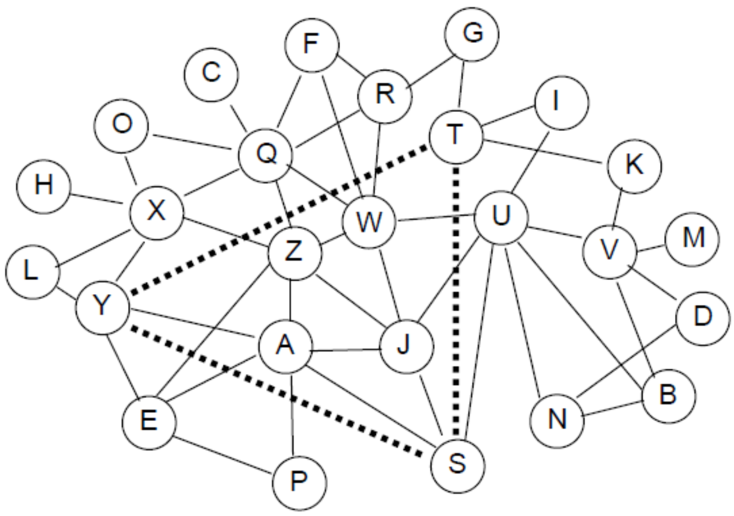


Figure 8. Solution 3.

enter(economic);

frontal(Nodes) = (hop(all_nodes); POWER >= *threshold*; NAME);

Nodes = (hop(Nodes); if(hop(link, Nodes), NAME));

enter(security);

Nodes1 = sequence(hop(B1, B2, B3); and(hop(link, Nodes); NAME), stop));

Nodes = Nodes1 & (hop(withdraw(Nodes1, Nodes)); nolinks; NAME);

enter(political); hop(Nodes); split(Nodes);

if(NAME > VALUE, linkup(ecopol, node(VALUE)))

5. Finding Multidimensional Communities

Finding different communities in a multidimensional world is considered as a very important and complex task (Yang, Zhou, & Chen, 2016; Huang, Chen, Ren, & Wang, 2021; Ambrosiano et al., 2020), with a related example following. In Figure 9 the initial community of interest is shown in dimension D1, which includes only nodes interconnected by special links named commun. We will then find same name interconnected nodes in other dimension, and so on, finally obtaining nodes that are interconnected in all considered dimensions. These will be nodes 2, 3, 4, and 6 in the final dimension D3, actually representing the *resultant multidimensional community*. The SGL solution for this stepwise spatial process may be as follows.

enter(D1); frontal(Nodes) = (hop(all); if(link(*commun*), NAME));
enter(D2); Nodes = (hop(Nodes); if((link, Nodes), NAME));
enter(D3); output(hop(Nodes); if((link, Nodes), NAME)))

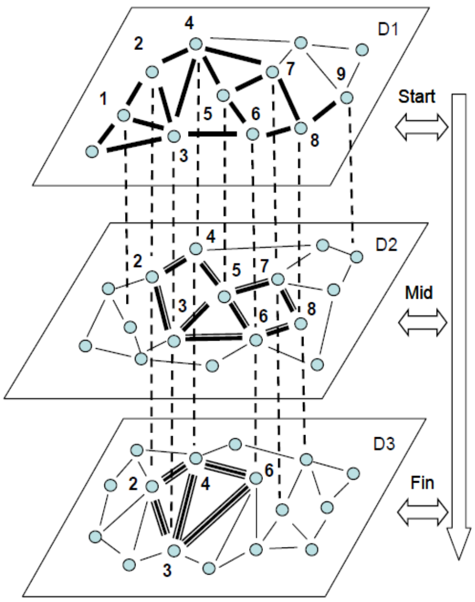


Figure 9. Obtaining Resultant community.

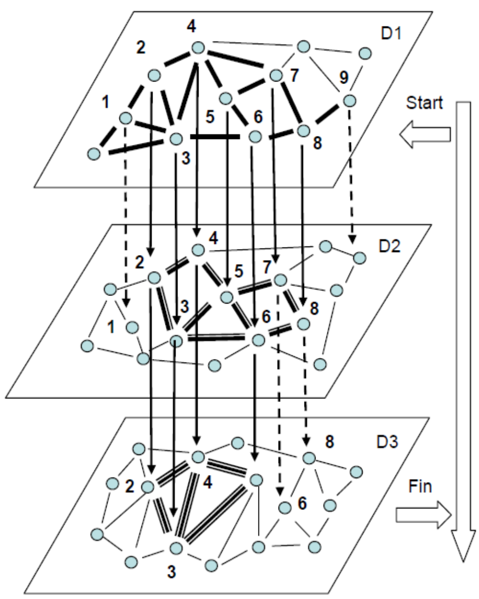


Figure 10. Using direct inter-dimensional propagation.

Another solution with direct propagation between nodes in different dimensions may be as follows (also shown in Figure 10), where only Start and Fin stages are explicitly represented, without Mid ones as of Figure 9. Resultant node names will be output individually by final nodes themselves, i.e. in the last dimension.

wait(wait(...
enter(D1); hop(all); if(link(*commun*), (shift(D2); mark)));
if((link, marked), (shift(D3); mark)));
....
output(if(link, marked), NAME))

6. Recovering After Disaster

Imagine that earthquake, explosion, or some heavy weather disaster (with the given center and radius R1) covered the geography dimension region surrounded by dashed border line in Figure 11, which includes nodes W and J. The recovery process may simultaneously involve different dimensions. Concerning communication and transport dimension, this should first outline and prepare the nearest transport network surrounding the damaged area (dashed line with radius R2), with road capabilities to be converted to recovery ones. Then, from nodes of this network, we may inform the nearest security, construction and economic agencies (dotted links in Figure 12), which can be potentially involved in recovery and rebuilding process, already having the prepared recovery routes for their operations (hard links in Figure 12). The following SGL multidimensional solution can organize this as follows.

frontal(Center = ..., R1 = ..., R2 = ..., Damaged, Around);
Damaged = (enter(Geography); hop(Center); cover(distance(R1)));
Around = (enter(Geography); hop(Center); cover(distance(R2));
notbelong(Damaged));
sequence(
(enter(Transport); hop(Around); hop(link(*transp*), Around);
if(NAME > BACK, linkup(*recovery*, BACK))),
(enter(Security, Construction, Economy);
hop(Around; hop(links(*sec*, *econ*, *tech*), not(Damaged));
operate(Damaged)))

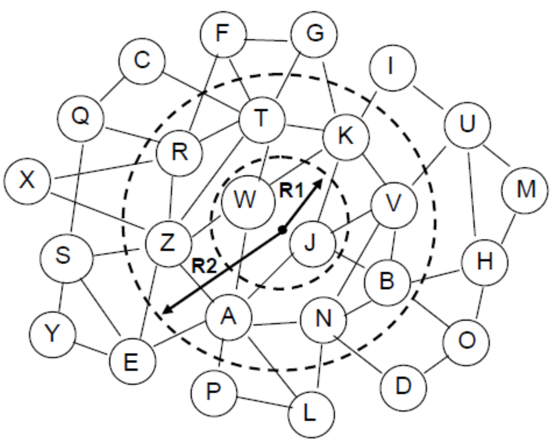


Figure 11. Disaster in geography dimension.

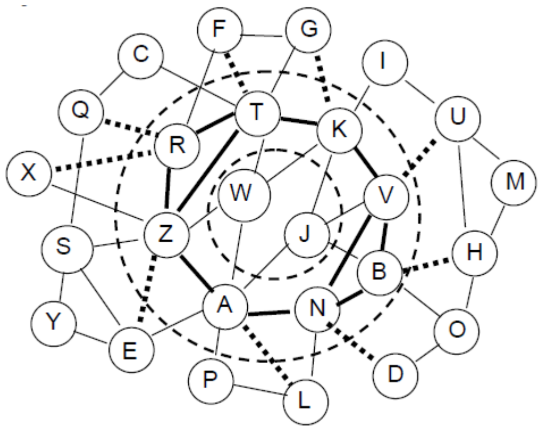


Figure 12. Surrounding roads and recovery dimensions.

7. Finding Close Ideological, Viral or Mental Communities

It is supposed that if somebody possesses a sort of hidden and dangerous mental or viral feature, than some very close human community with this person (say, organized as clique, with everybody actively communicating with each other), may be hypothetically considered as having this quality too. Imagine, at the beginning, that we implanted this viral feature into some human clique (1, 2, 3, 4, 5) at dimension D1 of Figure 13, via its node 3. Then if any member of this clique has same node, like 4, in another dimension D2 and happens to be member of some other clique in this dimension, we may assume that the whole new clique may potentially be infected via this node too, like clique (4, 6, 7, 8). Extending this process to dimension D3, which has versions of infected nodes 7 and 8 from D2, we may assume these nodes can also provide fully infected cliques like (8, 9, 10, 11) and (7, 12, 13, 14) in D3.

Only two steps of this spatial process are shown below in SGL, for D1 and D2, with more dimensions to be processed similarly, where cliques of interest are supposed to have at least 4 interconnected nodes. The output infected clique at D2 will be (4, 6, 7, 8).

```
frontal(Clique) = 3;
Clique =
(enter(D1); hop(Clique);
repeat(
hoplinks; notbelong(NAME, Clique);
yes(andparallel(hop(links, Clique)));
append(Clique, NAME));
count(Clique) >= 4; Clique);
enter(D2); hop(Clique); Clique = NAME;
repeat(
hoplinks; notbelong(NAME, Clique);
yes(andparallel(hop(links, Clique)));
if(PREDECESSOR > NAME, append(Clique, NAME), stop));
count(Clique) >= 4; output(Clique)
```

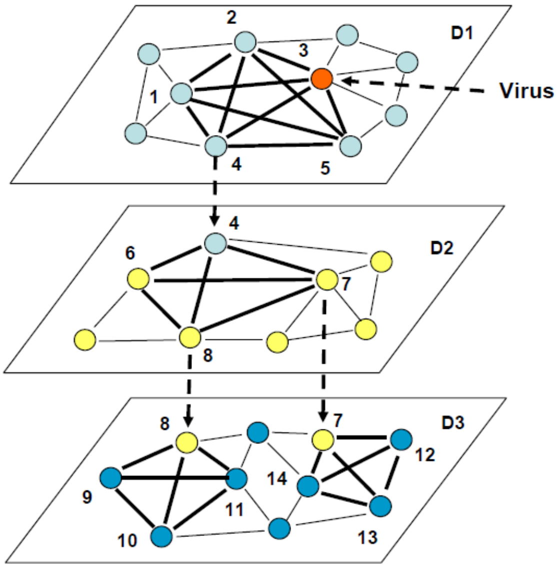


Figure 13. Finding dangerously infected communities.

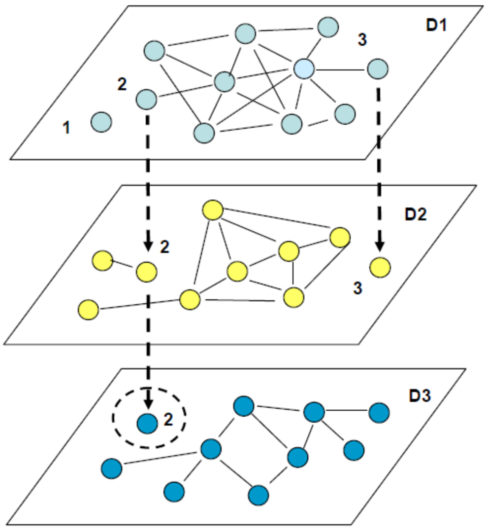


Figure 14. Finding mostly isolated nodes and groups.

8. Finding Mostly Isolated Nodes and Groups

To find weakest and most isolated parts in a multidimensional system, we will be looking here for nodes with minimum links to other nodes throughout different dimensions. Of most interest can be the nodes which are present in all dimensions, like node 2 (in D1, D2, D3) in Figure 14. Of partial interest, may also be node 1 (only in D1) and node 3 (in D1, D2). One of the goals for discovering and analyzing such nodes may be their further additional intensified development and strengthening, including linking with more nodes in different dimensions, thus strengthening the whole community too. Finding such nodes throughout all dimensions from D1 to Dn in SGL may be as follows (with threshold representing maximum number of links with other nodes which may still consider the node as weak or even isolated (especially with no links at all, as node 1). The multidimensional solution in SGL will be as follows.

```
frontal(Dim) = (D1, D2, ..., Dn);
enter(withdraw(Dim)); hop(nodes);
repeat(
if(count(links) < threshold,
orseq(shift(withdraw(Dim)), end(output(Name)))))
```

9. Interacting Physical and Virtual Dimensions

In a physical world dimension PW1 in Figure 15 the physical structure with nodes 1, 2, 3, 4, 5, and 6 is found, analyzed, and its detailed copy provided with all needed features of these nodes (like types, widths, heights, material, physical coordinates, etc.) and their interconnections. All these data are then stored as a special knowledge in virtual dimension KVW, which also accumulates similar information on many other structures, events, individuals and organizations, which can be effectively operated and processed on virtual level and also used in other dimensions, both virtual and physical. For example, using this stored physical data structure in KVW with a detailed additional formatting information `Format` (like on new node coordinates and shapes), a physical copy (say, reduced one) of the above mentioned physical structure can be created and placed in another physical world dimension like PW2 in its proper place, say, for its extended investigation and improvement. The multistage solution for this task using different dimensions in SGL may be as follows.

```
enter(KVW);
frontal(Nodes) = (1,2,3,4,5,6);
frontal(NodesP) = (enter(PW1); hop(Nodes); NAME & FEATURES);
frontal(Net) = (enter(PW1); hop(Nodes); NAME & (hop(links, Nodes); NAME)
enter(PW2);
frontal(Format = ..., Linktype = ...);
sequence(
(split(NodesP); create(VALUE[1] & update(Format, VALUE[2]))),
(split(Net); hop(VALUE[1], linkup(Linktype, VALUE[2])))
```

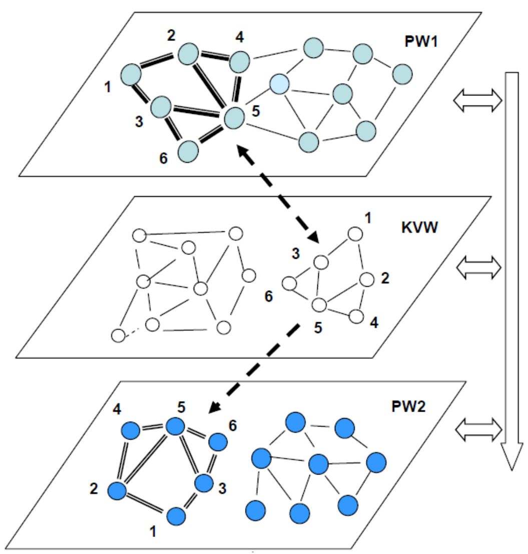


Figure 15. Interacting physical and virtual gimensions.

10. Conclusions

The paper confirms the necessity and high importance of understanding the distributed international world through its multiple dimensions, which needs detailed investigation separately and collectively to guarantee the proper world development. It also confirms suitability and efficiency of the developed SGT-SGL paradigm for investigating, modifying, and improving different dimensions and their holistic integration and management, where effective operations and solutions for the networked dimensions can be organized in parallel and fully distributed mode. And these solutions in SGL may be simpler and much more compact than with other models and languages (by experience with solving complex tasks in other areas, as already mentioned in [Sapaty, 1999, 2005, 2017, 2018, 2019, 2021, 2022, 2023, 2024a, 2024b, 2025a]). The latest SGL version can be effectively and quickly implemented in traditional environments and recommended to different local and global institutions, UN including, for the support of stability and evolution of the international community.

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