Applying GSN to Stroke Care

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Chapter 1

Introduction

1.1 Goal Structuring Notation [1]

This section presents an overview of GSN, in particular its notation to help the domain experts have a better understanding of chapter 2. Chapter 2 presents the results of applying GSN to stroke care. GSN is explained in more detail in chapter three of (Kelly, 1998b) and in (Habli et al., 2007).

> GSN explicitly represents the individual elements of goal-based arguments (requirements, goals, evidence and context) and (perhaps more significantly) the relationships that exist between these elements (i.e. how individual requirements are supported by specific claims, how claims are supported by evidence and the assumed context that is defined for the argument). When the elements of the GSN are linked together in a network they are described as a goal structure. (Habli et al., 2007)

However, in this report, we do not use GSN to create an argument, because for an argument a claim about the system is required. "A claim is a statement that you are asking the other person to accept" (Toulmin, 2009). In the case of stroke care system, the system does not exist and its top-level goals are not clear for the stakeholders, therefore there is not a statement that we want users to accept. In addition, we do not have enough evidence to support the functionality of this system. Instead, the process in (Kelly, 1998a) and the GSN notation is used for the process of goal-breakdown in constructing the goal structure. "The GSN technique adds a rich semantics to this goal-breakdown structure, by forcing the explicit recording of and justification for the strategies used to refine and relate the goals in a semi-formal argument structure" (Habli et al., 2007). However, GSN does not claim to be a goal identification method, on the other hand methods such as

[1] The information of this section is mainly from (Habli, Wu, Attwood, & Kelly, 2007).

GBRAM (Antón, 1996) and KAOS (Lamsweerde, 2009) propose approaches to identify and refine the goals.

Before starting using the GSN, the principal symbols of the GSN notation are presented in Figure 1.1 (with example instances of each concept). Based on the definition of GSN elements and their characteristics, and also the information that we have from stroke care, a set of these symbols are used in stroke care goal structure. A brief introduction to these symbols are as follow:

Modules are the top level view over the whole system. With the help of modules we can break the system into smaller subsystems that represent different aspects or views on the system. Each module contains the goal structure that can satisfy the top goal of the module. Modules also can have links to each other, hence some of the goals of one module can have relationship with some of the goals of another module.

goal "is a requirement statement expressed as a claim concerning some aspect of the system design, implementation, operation or maintenance" (Kelly, 1998b). Satisfaction of the goal depends on the satisfaction of the sub-goals.

Strategies are used to help decomposing the goals. It makes the relation between a parent goal and child goal clear (Kelly, 1998b).

Context "objects can be associated with Goals, Strategies and Solutions" (Kelly, 1998b). The context give us the ability to clarify an unclear part or keyword of the statements for the readers. For example, in a goal statement such as 'The system provides effective communication between stroke stakeholders', we can clarify the keyword 'stakeholder' for the readers to make them understand what exactly we mean by stakeholders, for instance 'Context: The stakeholders are the health professionals such as doctors'.

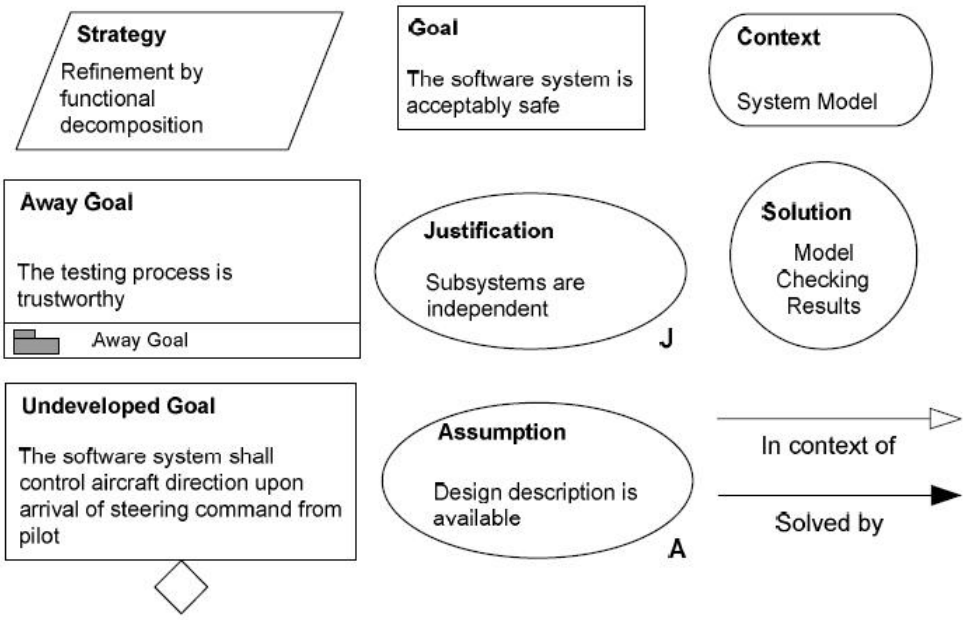

Figure 1.1: Element of Goal Structuring Notation taken from (Habli et al., 2007).

1.2 Stroke care

"Stroke has been described as 'an earthquake in the brain'. The shock waves of stroke can leave a lasting and profound impact on how people move, see, speak, feel or understand their world" (DH/Vascular Program/Stroke, 2007). Stroke is the third biggest killer in the UK (DH/Vascular Program/Stroke, 2007). Stroke care is not only about supporting people who have just had a stroke, but also "helping people of all ages establish and maintain a lifestyle that promotes good health and minimises the risk of ever having a stroke" (DH/Vascular Program/Stroke, 2007).

Stroke care is a management of medical procedure related to stroke within organisations such as NHS in UK. It contains different business processes in any related organisations such as governmental organisations and hospitals. It also, influences from different views over the goals and functionalities of stroke care system from different groups of stakeholders, for instance, politician, health specialists, IT specialists, and different groups of society members such as patient and their family. This organisational and medical system requires a strong and clear connection between different business processes and partners. Therefore, stroke care is an example of Enterprise Information System (EIS). There are different documents and proposals for this system that show the large group of society members and

organisations who are interested in achieving the goals of stroke care. After reviewing a group of the documents, "National Stroke Care" from department of health (DH/Vascular Program/Stroke, 2007) become one of the main resources in this report because in different chapters of it, we can see lists and descriptions of the non-functional requirements and soft goals, the example of these goals can be seen in chapter 2. However, the aim of using GSN is to present the goals and evidence to support the goals using various resources. The main resources that are used in this goal structure are:

- "National Stroke Care" document from department of health (DH/Vascular Program/Stroke, 2007);
- Interview with IT expert, which the interview's text is presented in appendix A;
- The report from (Leeds Team, 2008), which is a proposal from IT aspect;
- In some aspects, because of lack of available documents, realistic assumptions have been made.

1.3 Report structure

The aim of this document is to provide a GSN structure for stroke care in a form that is suitable to be evaluated by two groups of stakeholders: first, a GSN specialist, and second, a domain specialist. By evaluating the structure we want to assure that GSN is used correctly in this context from both a notation point of view and a process point of view. In addition, from the domain point of view, we want to assure that the goals of stroke care, which are captured and broken down, are valid. We also are interested to know how easy it is to understand this notation and its explanation for domain specialists, and if they would consider this notation for their future use to structure the goals of the rest of the stroke care system.

This report is structured as follows: considering the brief introduction to GSN (Section 1.1) and stroke care (Section 1.2), chapter 2 will present the results of applying GSN to stroke care. Chapter 2 contains the diagrams and explanations for the diagrams' elements. After presenting the goal structure, chapter 3 presents the evaluation criteria for collecting the readers' comments about the results presented in chapter 2. We shall thank all the specialists in advance, whom kindly accepted to review the results of this experiment.

Chapter 2

GSN and stroke care

This chapter presents the results of applying GSN to stroke care example. During applying GSN to stroke care, it become clear that GSN's process has limitations such as how to extract and refine goals. Therefore, after reviewing other goal-oriented approaches such as KAOS (Lamsweerde, 2009) and GBRAM (Antón, 1996), the concepts and guidance in their processes is used to fulfil the limitations. Thus, in addition to the results, the steps of the used process and evidences are introduced in this chapter. Describing the process's steps and evidences creates a more complete report for review; in addition, makes it possible for individuals to follow the steps and repeat the same process for other examples.

2.1 Stroke care modules

To start the process of extracting and refining the goals, based on the review on the literature of stroke care system and local brainstorming, I break down the system into modules. Stroke care system is a large and complex system that includes different groups of stakeholders with different viewpoints and different goals for the same system. Regarding to the idea of modularity in GSN domain, this idea was used in safety cases when the underlying architecture has a module structure (Kelly,). Kelly () said using modules gives the opportunity in safety cases to

- limit the extent of modification and revalidation
- support extensions and modifications to a 'baseline'

Figure 2.1 illustrates different modules in the stroke care system. Each module includes part of the goals of the system from different view points such as IT view point or social view point. After defining the modules, the investigation for the goals of each module and structuring the goals help the developers to construct the goal structure for the whole system. In

this report, because of the limitation of the information and time the goal structure for some of the modules will be presented. Indeed, using modules is not the only approach towards structuring the goals. For example, it is possible to use goals directly rather than the modules.

There is no specific process for investigating the modules, therefore, for this example, I used the same approach as searching for goals.

Process to find module in this example: *Searching for the main goals of the system* [1]*. Some of these main goals belong to the same category, therefore they will be considered as the goals of one module. The description of the module should clarify the main goals that the module will cover, it also should explain the view point towards the module. There is no need to explain the solutions in the module. It is very possible that different modules link together, hence the developer should think of the possible links between the modules and justify them. One good approach towards safe cross referencing between modules is explained in (Kelly, , P.11, P.12, P.13). Safe in the sense that the references is well documented to create traceability.*

Based on the earlier description of a process to define the modules, I created an eight step process:

1. Identify a set of goals, mainly top-level goals.
2. Categorise them in different groups based on different view points.
3. Make the view points clear and refine the modules.
4. Describe informally the domain of the goals that each module will contain.
5. It is not necessary to describe the solutions for the modules, but add the required data to clarify the domain of the modules.
6. Check for the links between modules.
7. Identify the goal(s) in each module that can be the bridges between the modules.
8. Where it is required create cross referencing between the modules.

Considering the earlier process, a list of top-level goals of the system were extracted from DH/Vascular Program/Stroke (2007) and brainstorming with domain experts. The investigations illustrate that in DH/Vascular Program/Stroke (2007, P.5, P.6, P.7) the main quality markers and plan for action describes most of the top level goals. Therefore after reviewing twenty different quality markers and ten point plan in addition to the brainstorming with experts, I refined four main modules (Figure 2.1). Following describes each module in Figure 2.1.

[1] The understanding of searching for the goals came from the processes in (Lamsweerde, 2009; Antón, 1996)

Policies: This module refers to the political point of view in the health domain (dealing with stroke). The letter from secretary of state for health (DH/Vascular Program/Stroke, 2007, P.2, P.3) about the importance of the stroke care illustrates the interest of government towards this system. In addition, because the financial resources are mainly from government, therefore, the top-level goals are considered as the goals that they want to achieve by developing this system. The review of (DH/Vascular Program/Stroke, 2007) illustrates that to achieve the goals of politicians in dealing with stroke, it is required to achieve the goals of three groups of stakeholders. The first group are the ones who deal with medical point of view, the second group are the ones who deal with social view, and the third group are the one who deal with IT view of the system.

Medical: This module refers to the medial goals and solutions for the stroke care system. Dealing with the stroke in the first sight is the responsibility of doctors, nurses, and other groups of health specialists, whose role is to study, investigate, and treat patients. A goals such as "High-risk TIA patients need to be assessed by experts" (DH/Vascular Program/Stroke, 2007, P.5) and "people with very severe stroke who are not expected to recover should receive active and life care" (DH/Vascular Program/Stroke, 2007, P.6) are the examples of medical goals which are directly mentioned in the documents. Therefore, considering these goals is essential for a system.

Social: The review on (DH/Vascular Program/Stroke, 2007) outlined a set of goals that refer to social aspect of this system. Goals such as "involving individuals and their carers in developing and monitoring services." (DH/Vascular Program/Stroke, 2007, P.5) or actions to improve public and professionals awareness of stroke symptoms (DH/Vascular Program/Stroke, 2007, P.7). The goals with the social aspect are considered as part of social module. Some of the goals of this module are shared with other modules.

IT: This module refers to IT goals, solutions, and systems. IT in this type of system deals with various business processes which are either define clearly or will be defined during the life of the system. Hence the boundaries of this kind of system can change over time. The reason to consider IT system is to facilitate the processes and functions of the business processes. Based on the proposal of an IT system in (Leeds Team, 2008), the interview with Prof. Richard Paige, who is an IT specialist that deals with stroke care system and the developer's assumptions, three sub-modules for IT module is considered. These three modules are the basic required module based on our review, however, the goals and goal structure inside each module can change

based on the elements such as requirements and technology limitations.

Collect the records: This module presents the IT goals of collecting stroke records. Study shows that in general and not particularly stroke "lack of robust comprehensive information as the reason why the NHS was failing to learn the lessons of past events" (COMPTROLLER AND AUDITOR GENERAL, , 23). By focusing on the patient records "local reporting has improved but there have been delays in establishing an effective national system" (COMPTROLLER AND AUDITOR GENERAL, , P.22). However, this system still faces with difficulties such as insufficient reports from ambulances that could be because of the nature of their role, time restrictions, or technology restrictions. Another problem which is indicated by (COMPTROLLER AND AUDITOR GENERAL,) is difficulties in processing the data "as many trusts have changes their system and therefore were only able to provide full data for the last two years" (COMPTROLLER AND AUDITOR GENERAL, , P.24). This difficulty point at the requirement for an enterprise level record collection method, therefore, the data can be compatible with different part of the system and can be used for the process functions. Based on the domain requirements, restrictions, and the available technologies the goal structure inside this module will be defined. It is possible that the details of the goals change during the time, but the main modules and top-level goals shall be defined in a way that have more stability.

Process the records: After collecting the records, this module presents the goal structure of processing the records. Processing the data of the records is a general goal in NHS; COMPTROLLER AND AUDITOR GENERAL () reported that "A number of local and national systems are in place for analysing and sharing lessons learnt, but most are under-used". Example of the requests that triggered the availability of a set of goals for processing the records in stroke care is as follows: "effective assessment and management of vascular risk factors, together with improving information and advice on lifestyle and treatment options (QM2)" (DH/Vascular Program/Stroke, 2007, P.5). The results of processing the records can be the statistical knowledge for scientific use such as treatment options or effective assessment and management of vascular risk factors. Even the results can be sorted raw data for doctors and nurses regardless of time and place, to inform them about patients situation. Any kind of processes that can be requested by different groups of stakeholders can be a goal for this module. Focusing on the processes can help to improve the science of health and stroke care system, it also can help to evaluate the achievement of goals.

Share the data and/or information: This module illustrates the sharing of the processed data, information, or knowledge from previous module that is based on our assumptions. To improve the service, "the new vision for stroke care demands service working together in networks" (DH/Vascular Program/Stroke, 2007, P.8). Sharing the data and information allows a wider access to the data that can help another patient to survive. It also helps to provide the required information for mobile patients, doctors and nurses can have access to their records from anywhere, not just in their local health centre. Sharing considering the authentication of the user, security and safety of the data. By authentication we mean the right users shall have access to the right level of data. By security we mean that the data should not be available outside the system, specially if it is confidential and safety here means that the correct data is circulated within the system. Sharing is a sensitive process for NHS and patients as it can be a confidential information.

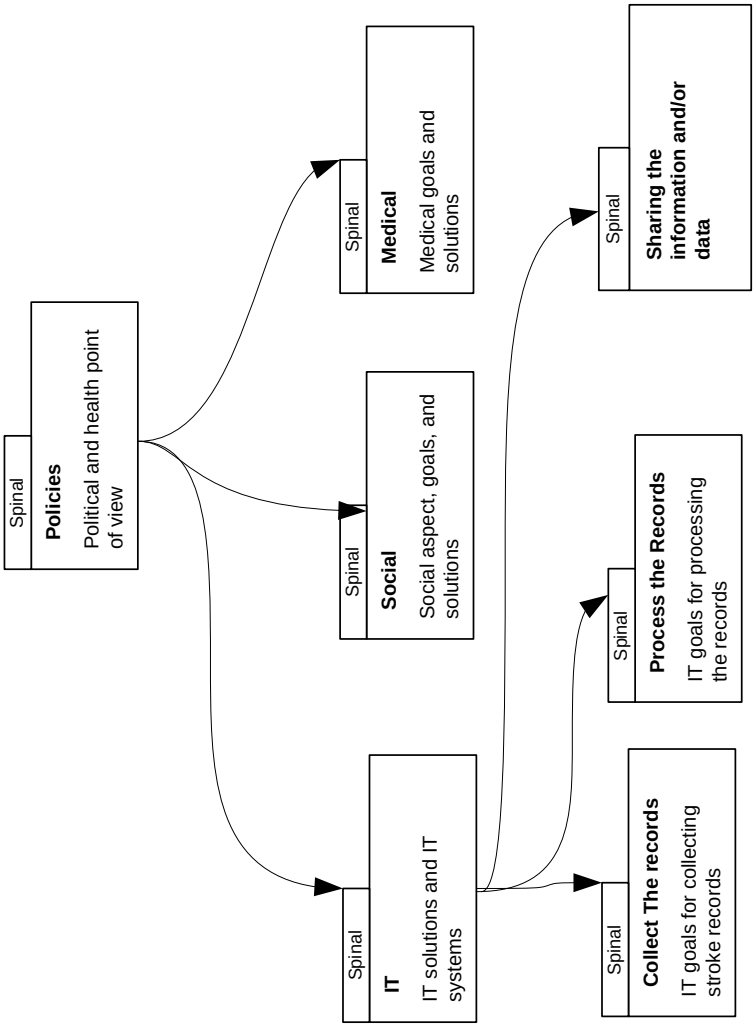

Figure 2.1: Stroke Care Modules. Packages are standard GSN notation, Spinal and Context are part of the GSN package in Visio and are ignored in this report.

2.2 Goal structure of Policies module

After defining the modules of stroke care system, the next step is to present the top-level goals of each module. As discussed in Section 2.1, 'Policies' and 'IT' are the modules considered for goal refinement. The process that is considered for identifying the main goals is based on the documentation of (Lamsweerde, 2009; Antón, 1996; Kelly, 1998a, 1998b) and is as follows:

- The goals should be statement that can be true or false. It can be true when the goal is achieved.
- Search for strategic objectives, business goals and policies.
- Search for domain specific objectives.
- Search for action words: action and operations.
- Requirement elicitation

The goal structure for 'Policies' and 'IT' do not contain any solutions yet. Figure 2.2 illustrates the goals refinement of the Policies module using (DH/Vascular Program/Stroke, 2007) document (explained in Section 1.2). Figure 2.2 presents the whole goal structure inside 'Policies' module. In Figure 2.3, Figure 2.4, and Figure 2.5, different parts of Figure 2.2 are shown separately to make it more readable. Following sections illustrates these figures in more detail.

2.2.1 Elaborate GP0 of Policies module in Figure 2.3

GP0- *The system supports people who have had a stroke and helps people to maintain a lifestyle that minimises the risk of having stroke (DH/Vascular Program/Stroke, 2007):*

The investigations illustrate that dealing with stroke has two main aspects (DH/Vascular Program/Stroke, 2007, P.7). The first aspect is to treat and support the people who have had a stroke or the patients who are suffering from stroke. The second aspect is preventing stroke by supporting healthier lifestyles the general lifestyle of people, who should be guided towards healthy habits. This can help the government to save the large amount of resources every year.

SP1- *Refinement by a new national strategy for stroke services in England developed by Department of health (DH) (DH/Vascular Program/Stroke, 2007):*

The strategy to address GP0 is to investigate what are the sub-goals that can satisfy GP0. It is emphasized in (DH/Vascular Program/Stroke,

2007) that the document does not provide any detailed clinical guidelines, hence the sub-goals will continue to have the social and mainly political view.

GP1- *A quality framework against which local services can secure improvements to stroke services and address health inequalities relating to stroke over the next ten year is provided (DH/Vascular Program/Stroke, 2007):*

In page 12 of the cited document, the three goals that should be achieved by the chosen strategy for the stroke services are clearly defined. GP1, GP2, and GP3 are these three main goals.

GP2- *Advice, guidance and support for commissioners, strategic health authorities, the voluntary sector and social care, in the planning, development and monitoring of services is provided (DH/Vascular Program/Stroke, 2007):*

Illustrated in GP1 explanation.

GP3- *The expectations of those affected by stroke and their families are informed, by providing a guide to high-quality health and social care services (DH/Vascular Program/Stroke, 2007):* Illustrated in GP1 explanation.

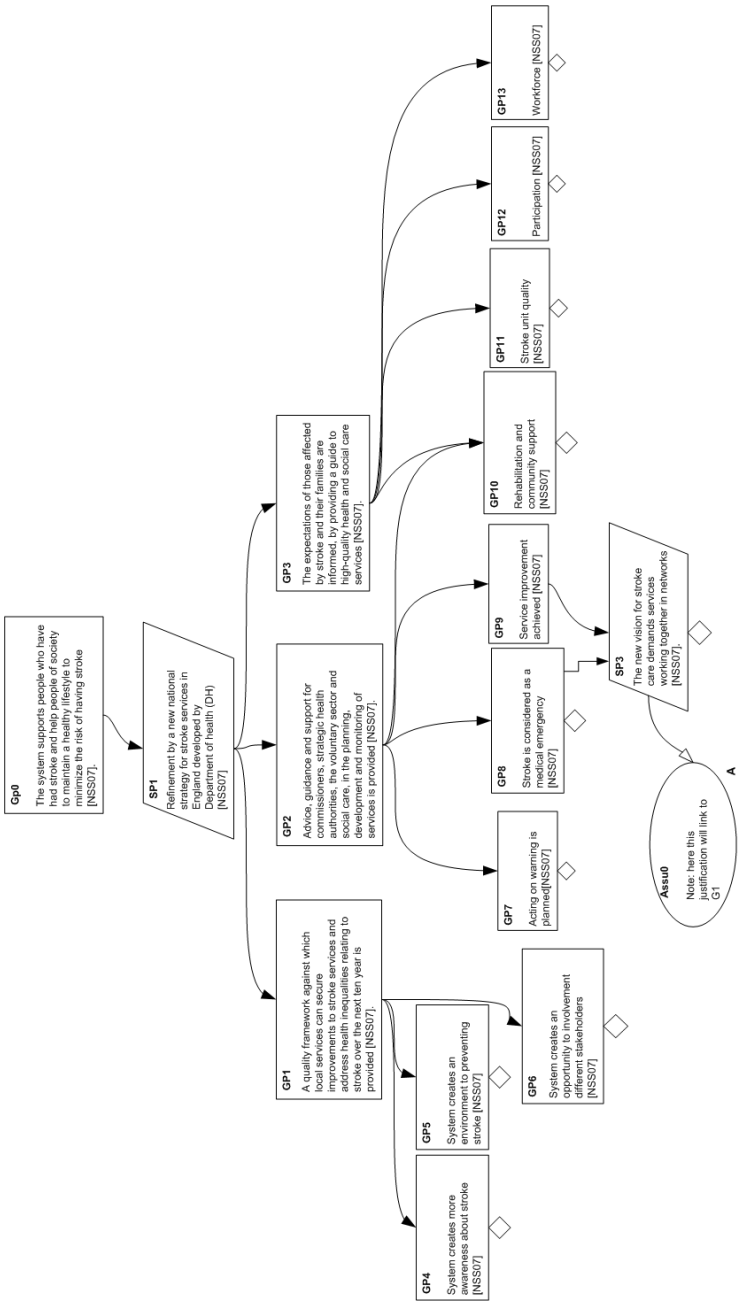

Figure 2.2: Complete view on goal structure of *Policies* module.

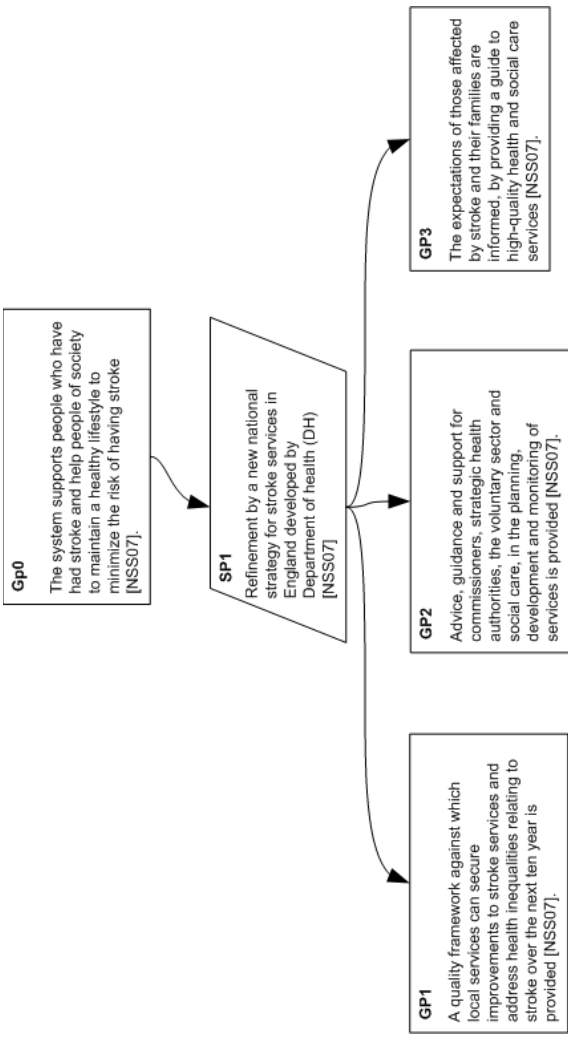

Figure 2.3: Focused view on the first two layers of the *Policies* module's goal structure.

2.2.2 Elaborate GP1 of Policies module in Figure 2.4

GP1- *A quality framework against which local services can secure improvements to stroke services and address health inequalities relating to stroke over the next ten year is provided (DH/Vascular Program/Stroke, 2007).*

The strategy to break down GP1 and create more detailed sub-goals is to analyse our main reference. Based on the investigation and analysis done on this document, "there is a clear desire for more emphasis on prevention and on public awareness" which requires involving different groups of public to cooperate with each other.

GP4- *Awareness (DH/Vascular Program/Stroke, 2007)*

This goal present the need for creating public awareness about stroke, based on the survey in this document, (DH/Vascular Program/Stroke, 2007), many people do not know what is the stroke, what are its symptoms and they do not know that they should call 999 in short time. Therefore, providing these information for the public can create a more knowledgeable environment about stroke. There are strategies to provide this awareness for the public which shows "increasing opportunities for transforming the lives of people who are at risk of stroke, or who have had a stroke" (DH/Vascular Program/Stroke, 2007). Strategies such as examining the different experiences of other countries.

GP5- *Preventing Stroke (DH/Vascular Program/Stroke, 2007)*

Same as creating awareness, preventing stroke is another goal towards achieve the top-level goal, GP1. This goal is very important for the health specialists in NHS and government, because it not only reduce the associated suffering from stroke but also lead to NHS savings, which is approximately 15,000 to treat each patient over five years. Page 19 of (DH/Vascular Program/Stroke, 2007) explain in more detail the groups of people who can benefit more from prevention, hence it emphasises the importance of preventing stroke with more detailed argument and explains the current strategies. Strategies indeed can change during the time but the goal which is preventing the stroke is a more stable goal.

GP6- *Involvement (DH/Vascular Program/Stroke, 2007)*

This goal in more detail refers to involving individuals in developing services. The success of this goal will achieve when "People who have had a stroke and their carers are meaningfully involved in the planning, development, delivery and monitoring of services. People are regularly informed about how their views have influenced services" (DH/Vascular Program/Stroke, 2007). Page 23 of (DH/Vascular

Program/Stroke, 2007) documented the rational behind this goal and the required actions. As it was mentioned in the case of 'Preventing Stroke' goal, the actions and strategies can change based on the environment variables such as the available technologies. However, the main goal, which in this case is involvement, is more stable and static.

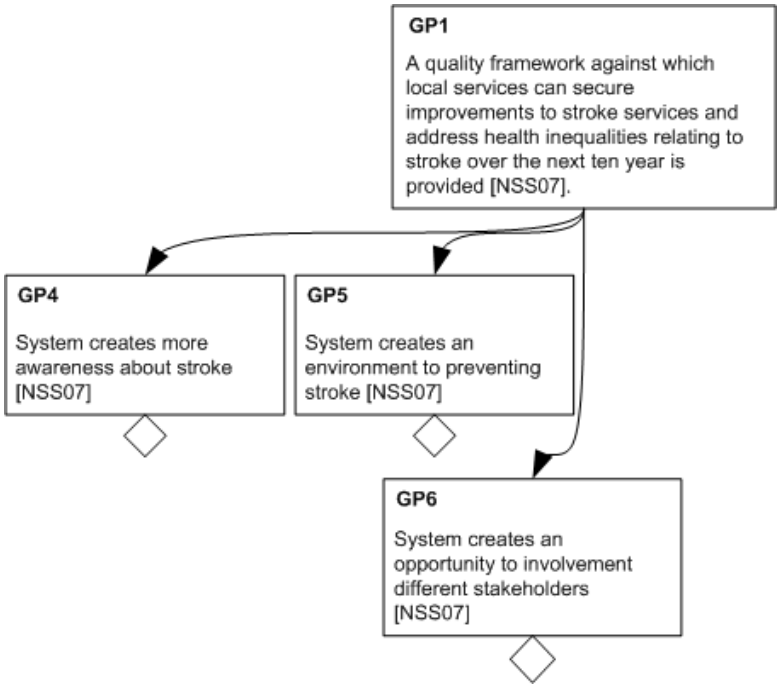

Figure 2.4: Focused view on GP1 and its sub-goals from the *Policies* module's goal structure.

2.2.3 Elaborate GP2 and GP3 of Policies module in Figure 2.5

GP2- *Advice, guidance and support for commissioners, strategic health authorities, the voluntary sector and social care, in the planning, development and monitoring of services is provided (DH/Vascular Program/Stroke, 2007).*

GP7- *Acting on the warnings (DH/Vascular Program/Stroke, 2007)*

There are clear signs of possibility of stroke in the future; for example transient ischaemic attacks (TIAs). Therefore, the system should consider some actions in a short time for this group of people. For example, for the TIAs patients who may have stroke in 24 hours the system should consider units with the ability of scanning the brain.

GP8- *Stroke as a medical emergency (DH/Vascular Program/Stroke, 2007)*

This goal refers to ''getting people to the right hospital quickly where there are specialists who can deliver acute treatments including thrombolysis – will save lives" (DH/Vascular Program/Stroke, 2007).

GP9- *Service improvement achieved (DH/Vascular Program/Stroke, 2007)*

This goal which is phrased as a new vision for stroke care demands "services working together in networks, looking across all aspects of the care pathway" (DH/Vascular Program/Stroke, 2007). In general this goal consider the solutions and plans for stroke network to improve the services. For example, in the case of an urgent response to the stroke one of the required action is to transfer the patient to the suitable stroke unit. "This will need discussion across a network of stroke service providers to agree which centre(s) will provide these services" (DH/Vascular Program/Stroke, 2007).

GP10- *Rehabilitation and community support (DH/Vascular Program/Stroke, 2007)*

This goal refer to "intensive rehabilitation immediately after stroke, operating across the seven-day week" (DH/Vascular Program/Stroke, 2007). Satisfying this goal helps to satisfy not only GP2 but also GP3, because it affects the goals to satisfy the patients and their families from the stroke care system.

GP3- *The expectations of those affected by stroke and their families are informed, by providing a guide to high-quality health and social care services (DH/Vascular Program/Stroke, 2007).*

GP11- *Stroke unit quality (DH/Vascular Program/Stroke, 2007)*

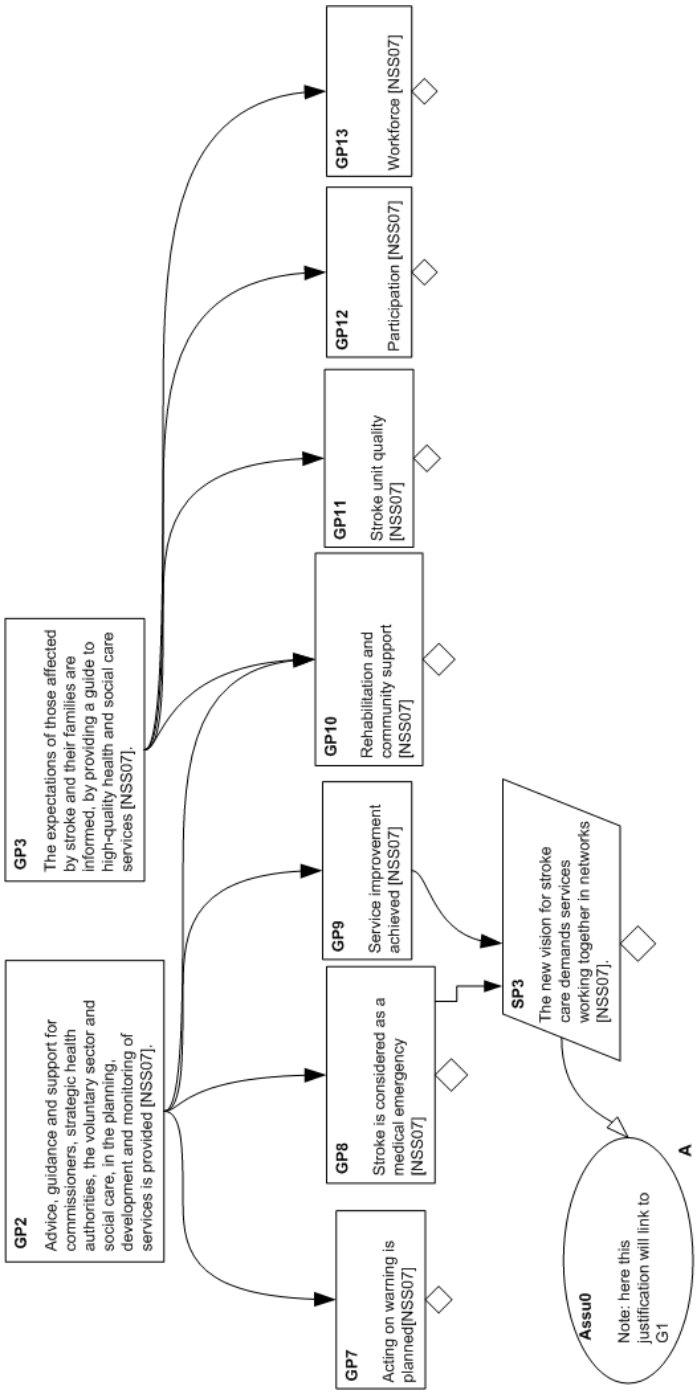

Figure 2.5: Focused view on GP2, GP3 and their sub-goals from the *Policies* module's goal structure.

Other than rehabilitation techniques the stroke unit quality is another unit to help the patients who had stroke and their family to improve the skills of the patient.

GP12- *Participation (DH/Vascular Program/Stroke, 2007)*

This goal refer to "assistance to overcome physical, communication and psychological barriers to engage and participate in community activities helps people to lead more autonomous lives and move on after stroke" (DH/Vascular Program/Stroke, 2007).

GP13- *Workforce (DH/Vascular Program/Stroke, 2007)*

"people with stroke need to be treated by a skilled and competent workforce" (DH/Vascular Program/Stroke, 2007).

SP3- *The new vision for stroke care demands services working together in networks (DH/Vascular Program/Stroke, 2007).*

GP8 and GP9, both refer to the requirement for a system that can create a suitable network between different units and specialists to deal with the stroke care in emergency and normal situations. This justification will link these goals to the IT module, which investigate the goals for the IT aspect of the stroke care. A system that can create the suitable network and services.

2.3 Goal structure of IT module

The next module to be presented in more detail is IT module. The following sections illustrates the goals that are refined for this module.

2.3.1 Elaborate G1 of IT module in Figure 2.6

G1- *The system provide effective communication between stroke stakeholders.*

Stakeholders in this case can be different agents, users, or components that hold an stake of the system. Hence the top-goal from the IT point of view and based on the earlier justification required to provide effective communication between stroke stakeholders.

Cont1- *The stakeholders are the health professional such as doctor and non-health professionals such as patient and other people of the society (DH/Vascular Program/Stroke, 2007).*

The definition of stakeholder in the case of this system and G1 is defined here to create clarity.

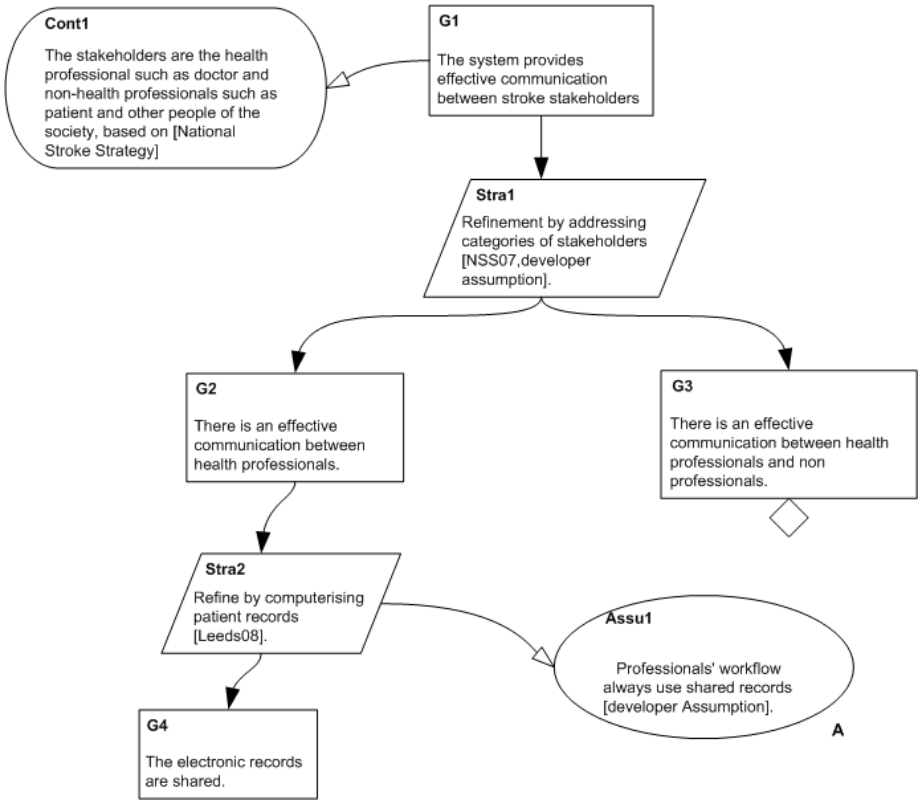

Figure 2.6: Focused view on G1 to G4 from the *IT* module's goal structure.

Stra1- *Refinement by addressing categories of stakeholders (DH/Vascular Program/Stroke, 2007) and the developer assumption].*

The investigations in (DH/Vascular Program/Stroke, 2007) and (Leeds Team, 2008) it become clear that this system deals with different group of people who are affected by stroke from different aspects. The developer assumes the main to categorise the stakeholders are the one who are health professionals such as doctors and nurses, and the ones who are not health professionals such as patient and the families.

G2- *There is an effective communication between health professionals (Leeds Team, 2008).*

Based on the descriptions in (Leeds Team, 2008) it become clear that the system should provide an effective communication between health professionals such as prevention, acute treatment, and rehabilitation.

G3- *There is an effective communication between health professionals and non professionals (Leeds Team, 2008).*

Based on the diagram in (Leeds Team, 2008) and the earlier goals in

policies module it become clear that in addition to the communication between health professionals, there is communication between non-professionals and professionals.

Stra2- *Refine by computerising patient records (Leeds Team, 2008).*

The proposal of using IT technology to handle part of the stroke care system in (Leeds Team, 2008), the interview with IT specialists who is involved in stroke care, and the developer's assumptions, they all lead to G4.

G4- *The electronic records are shared.*

As it is explained in Assu1, sharing the electronic records safely and securely is a goal in the new stroke care system.

Assu1- *Professionals' workflow always use shared records [developer Assumption].*

This assumption is made by developer to justify the reason to computerise and share the electronic records. In the current system it is possible that health specialist do not share the records, but in the future stroke system, sharing the electronic records safely and securely is a goal that has its own benefits and challenges.

2.3.2 Elaborate G4 of IT module in Figure 2.7

G4- *The electronic records are shared.*

Stra3- *Refinement by addressing the management process of patient records [Prof.Paige interview, developer assumption]*

To make the benefit from shared record and to provide suitable access and reasonable security for this sensitive data, there should be a defined and systematic management for the records.

Cont1- *Management process of patient records consists of collections, processing, sharing.*

The context in Cont1 explain the management in more detail to help the strategy stra3 become more clear. It also provides justification for creating G5, G6, and G7.

G5- *The records are collected.*

This goal contains the sub-goals and solutions for collecting the records of patients; therefore, as it was described in Figure 2.1 this goal by itself is a module. Stra4 and G8 are the strategy and goal which we can consider based on the current data that we have. The collect record module will be described in more detail when the assumption and required information can be obtained.

Stra4- *Refinement by addressing the collection process*

G8- *The records will be collected from different sources and will be stored in the database [Prof.Paige interview].*

G6- *The data of the records are processed.*

After collecting the data this goal refers to processing them for the purpose of statistical studies for instance. Similar to G5, this goal is a module by itself and it can be changed based on the technology and new goals or requirements.

G7- *The data and information are available to the authorised stakeholders.*

After collecting and processing the data, the data and/or information based on the user's request and authorisation will be available.

Cont5- *Process the data of the record will produce some information which can be used for other purposes such as statistics for studies [developer assumption].*

Cont4- *Authorised stakeholders: The level of access to the information is different for different group of health professionals [developer assumption]*

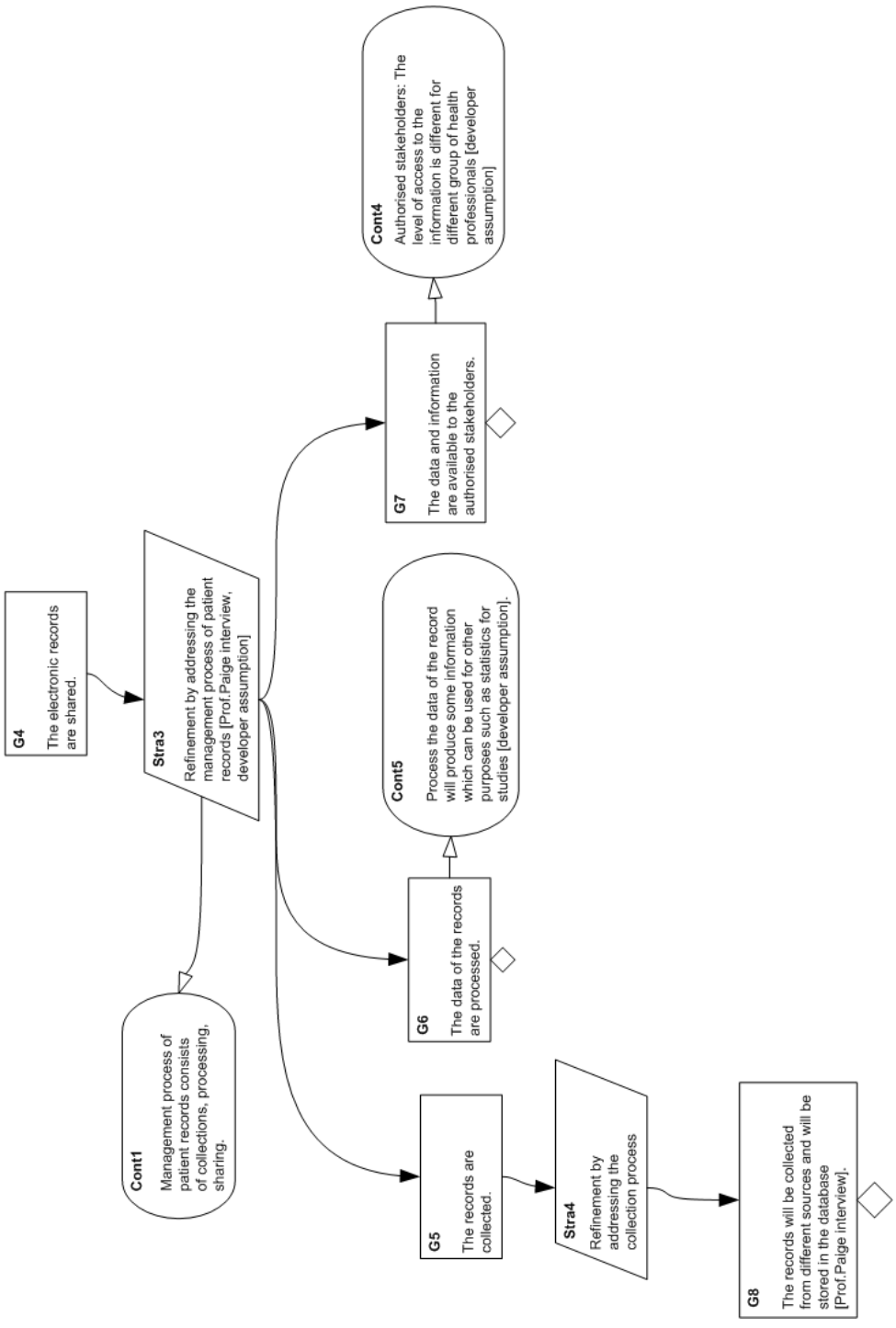

Figure 2.7: Focused view on G4 to G8 from the *IT* module's goal structure.

Chapter 3

Evaluation

Kelly (2007) provides the following criteria for reviewing assurance argument.

- Step 1 - Argument comprehension
- Step 2 - Well-formedness checks
- Step 3 - Expressive sufficiency checks
- Step 4 - Argument criticism and defeat

These criteria are based on the idea of creating an argument, therefore this evaluation criteria can not be used in this example because there is no argument. However, we can use the concept in each step and revise it for this case. Therefore, for each step I created some questions that can be considered while reviewing chapter 2 as well as your comments about the points that are not covered in this review criteria.

Are you a GSN specialist? Are you a Domain specialist (Domain means Stroke care system)?

Goal structure comprehension: "the reviewer can understand the argument being presented" (Kelly, 2007).

- What is the aim of making the goal structure?
- What is the aim of stroke care system?
- What is aim of defining these modules?
- Are the top goals understandable?
- Do you think the top goals should be different from what is presented?

Well-formedness checks: This item search for structural errors. "Even before looking at the detail of the argument, it can be possible at this stage

to identify structural errors.For example, circular arguments (in which the premises of the argument depend in some way on the conclusions of the argument) are rarely considered acceptable" (Kelly, 2007).

- Are there any floating claims? ("Floating claims are the claims with no support" (Emmet & Cleland, 2002)):
- Is there any case that the "Networks having more than one top-level goal" (Emmet & Cleland, 2002)?
- Can you identify any network circularities? (in network circularities the top goals are dependent on the results (Emmet & Cleland, 2002))
- Can you identify the cases that the role of the evidence is not clear?
- Is it possible to follow the flow of the structure? Or you think there are missing parts?
- Are the GSN components used correctly?

Expressive sufficiency checks "The purpose of this review is to assess whether the arguments have been sufficiently expressed in order for the argument to be truly understood" (Emmet & Cleland, 2002).

- Is the goal structure understood?
- Can you identify where the goals are not clear?
- Can you identify where the strategies are not clear?
- Can you identify where the context are not clear?
- Is there any element missing from the goal structure that prevent gaining a full understanding of the goal structure?

Argument Criticism and Defeat

- **Considering the ultimate (final goal of the system) of the system, do you think the goal structure is going towards the conclusion?**

  ***Dependency* is about the dependency of the multiple forms of evidence. This attributes check if the evidence are independent, hence they have more value compare to the evidence which are dependent (Kelly, 2007).**

- **Considering the definition of dependency, do you think the evidence given in this goal structure are independent?**

  ***Definition* is assuring the checks for undesirable over–constrain or under–constrain evidence or other elements of the goal structure, or the goal structure by itself (Kelly, 2007).**

- **Considering the earlier definition of 'definition' can you identify any undesirable over–constrain or under–constrain?**
- **How relevant is this goal structure to achieve the ultimate system? (*Relevance* (Kelly, 2007))**
- **How fragile is this goal structure to the possible changes of the goals and the environment variables for instance? (*Robustness* (Kelly, 2007))**

I remind that the aim of this evaluation is to answer two main questions:

- **First: Do GSN experts think that the GSN process and notation is used correctly in this example?**
- **Second: We also are interested to know how easy to understand is this notation and its explanation for domain specialist and if they may consider this notation for their future use to structure the goals of the rest of the stroke care system?**

Appendix A

Prof.Richard Paige Interview

During an unstructured interview with Prof.Richard Paige, he discussed the goals of the system based on his knowledge about this system and his presents in the meetings regarding to this system. The content of this interview is confirmed with him for further use in this research. A list of goals for the ideal system is as follow:

This system contains a large-scale distributed database and various methods for inserting data. This system also supports health practitioners who never used such a system as well as users with sophisticated input devices such as mobile, laptop, etc.

The scenario for the users who do not use electronic input device is as follow: A nurse visits a stroke patient in the house. She/he records the information about the status of the patient in a paper based form, later this information would have fed to the system.

The database has a complex front end and it is not clear what data to gather from the patients. Even though, there are possible stroke indicators that are the input data, but there is no evidence to support what is the right data to record. Therefore, it is considered that this system allows the users to collect the evidence of stroke from all over the UK.

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