A review of
Global Analysis

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Global Analysis (GA) is a method for analysis of factors that influence the software architecture. GA is presented by Hofmeister et al. in the book 'Applied Software Architecture' [1]. It is a method that is invoked before any real architectual work are started, and is used, or reviewed, throughout the entire engineering process.

I have included it in my litterature review because of its structured approach to identifying and grouping influencing factors. And because the model by which it seeks to handle them.

Typical system architectures are complex entitites, with an even broader range of potential influencing factors. (I defined a factor as an physical or conceptual element which influences a process to a certain degree. Factors can be represented in a quantative or qualitative way, depending on their nature and how well they are understood). Factors can be grouped in to two main categories, those that restrain the system, and those which makes it more flexible. Some factors affect the system as a whole, while others influences only parts of it. Due to the aboundance of influencing factors, and their impact, addressing them from the very beginning in a project may save expensive rework. Furthermore, keeping the factors monitored and visible througout the project minimizes the risk of building localized solutions which amplifies the negative factors and dampen the positives.

The primary purpose of performning GA is to get a systematic approach to identifying, accomondating and describing the factors which could affect the architecture, and then to build strategies which foresees and acknowledge the potential consequences. The methods complement the risk and requirements analysis typically performed in the initial project stages. These methods and the activity of realising them has been called Global Analysis due to the systemwide effect. The factors cannot generally be constrained within one component or project phase, so the strategies for handling them should be buildt within the perspective of the entire project lifecycle.

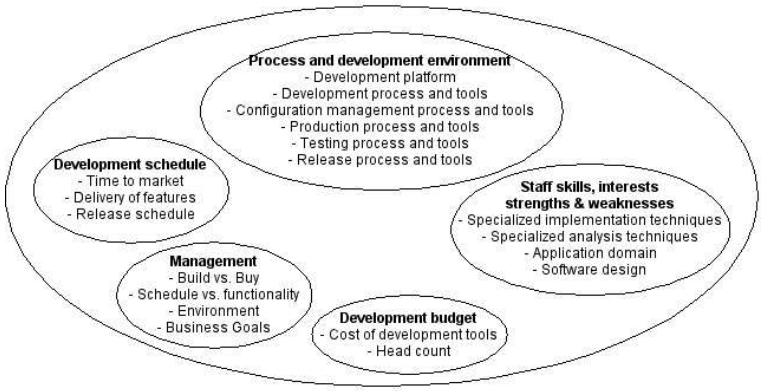

Figure 1: Typical organizational factors

The identified factors could be coupled in both simple or complex ways, some may have conflicting consequenses or could potentially impose impacts not only to the system itself, but to other factors as well.

1 Categories of Global Analysis factors

GA divides factors into three groups, many other articles working in the same area includes the same groups, some extend them. Keep a strict focus on the litterature reviewed in this part, I will only look at the groups identified by GA. In each group, GA, lists a set of stereotypical factors divided into categories.

1.1 Organizational factors

These factors do not directly describe the product, instead they try to capture organizational aspects which could affect the system. The factors constrain the design choices, if they are ignored the architecture may not be able to be implemented in a functional way. The impact scope of the organizational factors vary. Some, like project budget and deadlines, affect only single project. While other factors like culture and processes affects every project in the organization.

Since most of these factors are relatively product independent, they may seem more flexible. But this is not a generally appliable case, rather it depends on some of the factors themselves, such as organizational culture and envirmental factors. But in an overall perspective, GA tends to focus more on the flexibility of orgazational factors than on changeablility.

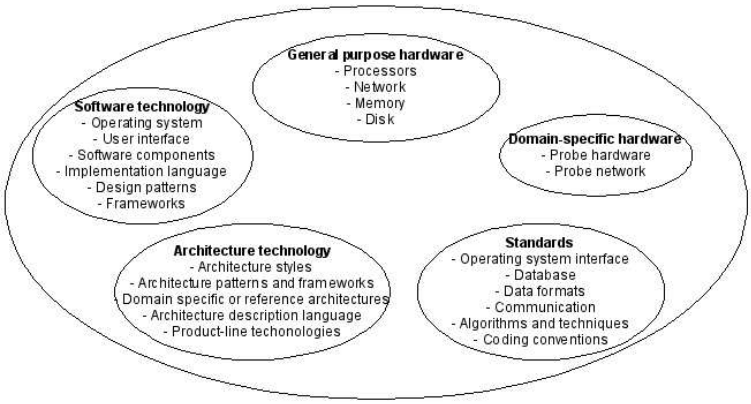

Figure 2: Typical technological factors

1.2 Technological factors

Factors in this group arise from the external technology solutions that are embedded/embodied in the product. These factors are typically more obvious to identify than most other factors as design choices are limited by the kinds of hardware and software and standards that are currently available. But factors in this category are often the ones that changes the fastest. Eventhough these factors does not describe the product directly either, they do have a large impact on the system design and implementation. So the system architecture should take close notice on these factors and be designed in such a way that difficulty of adaptation is minimized. Contrary to orgazational factors, techonological factors emphasize changeability over flexibility.

1.3 Product factors

Are the primary influence on the architecture, this category covers the functional features of the products and one should consider both cost, performance and dependability. Product factors has a larger impact on the system than factors from the other groups. They are prone to change throughout the entire project. Product factors puts an equal amount of emphasis on both the flexibility and changeability factor aspects.

2 Global Analysis activities

Global Analysis imposes two activities for identifying and handling factors. The activites strives to identify the most important factors first so that they may be taken into consideration when designing the system from the very start. The goal is to develop strategies which define actions steps for

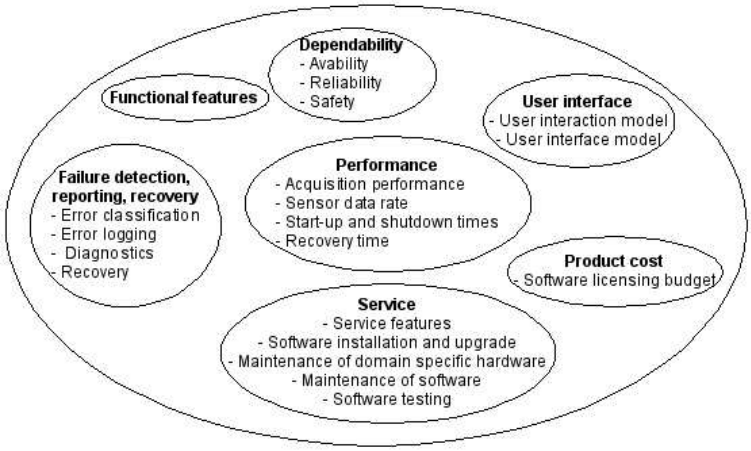

Figure 3: Typical product factors

eventual problems. Figure 4 illustrates the method flow where each activity contains three steps.

The first activity focuses on analyzing the factors by taking input from the three factor categories discussed in the previous section. If no explict factor knowledge is present, then the first step in this activity is identifying and describing factors. One should primarily consider factors which has global impact, those which is liable to change, those which one has little experience with and finally those which are difficult to statisfy.

To determine whether a factor has significant global influence, considering the following three questions may clarify the scope.

1. Can the factor's influence be localized to one component in the design, or must it be distributed across several components?

2. During which stages of the development is the factor important?

3. Does the factors require any new expertise or skill?

When the initial set of factors has been identified, its time to analyse them. Besides the impact, the two most important aspects of a factor is its flexibility and its changeability. Flexibility in this context refers to the extent the factor itself can be influenced in order to adapt it better to the system. A flexibility analysis typically requires looking at how the factor can be influenced, and to what extent.

Changeability refers to what may change about the factor during its entire lifespan. The changeability may occur both as an result of an change in the internal aspects of the factor, or due to some external effect. So one

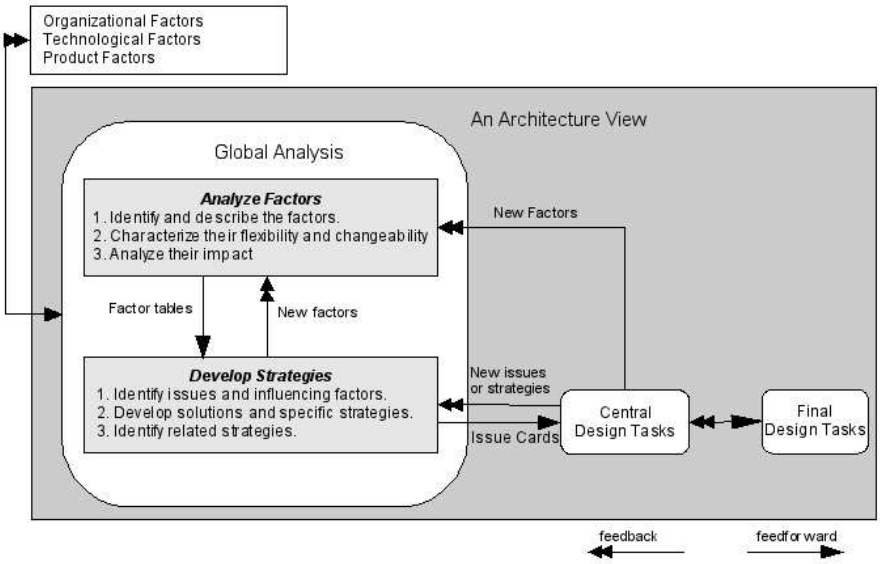

Figure 4: Typical product factors

should consider in what way a factor may change, if there is any point in time where the change possiblity is higher and what scope the change affects.

When the flexibility and changeability of the identified factors has been analysed, all that is left in the first activitiy is to consider the impact of each factor. What impact could the factors have on the system, and if a factor should change, how would the other factors, the system components, system operation and other design decisions be influenced?

Global Analysis recommends keeping track of the factors and their aspects in a factor table which records the flexibility, changeablitiy and impact of each factor.

The next action step is to develop strategies for the system design or the implementation. Again, referring to figure 4, Global Analysis defines three steps for this activity, they all build upon the factor table constructed in the last activity.

The first step in developing strategies is considering each scope category (organizational, product & techonogical) and trying to discover important issues which may be influenced by the factors. Issues may be the element spawning factors, or factors could be the creator of issues, so there is no one-track way of developing strategies. Issues may emerge from limitations or constraints imposed by factors, or it may result from the need to reduce impact of factor changeability. Issues may develop over time as more and more factors are identified, as a consequence issues are cross-category spanning.

Each identified issus is handled by developing a strategy that address the issue to ensure the overall succes of the system. Strategies should address one or more of the following goals:

- Reduce or localize the influence of the factor.
- Reduce the impact of the factor's changeability on the design and other factors.
- Reduce or localize required areas of expertise or skills.
- Reduce overall time and effort.

The last step in developing strategies is to avoid repeting other strategies. So when an issue is identified and a strategy developed, one should review other existing strategies to identify areas of overlapping interests and factors.

Again, Global Analysis reccomends using a formalized approach for communicating strategies by deploying a standardized issue card.

When Global Analysis is complete, all the important influencing factors will have been characterized and strategies for ensuring buildability, implementation and changeability of the product and its architecture will have been ensured.

References

[1] Soni Hofmeister, Nord. *Applied Software Architecture*. Addison Wesley, 2000.