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Applications of Varying Leadership Structures for Software Engineering Teams

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Applications of Varying Leadership Structures for Software Engineering Teams

A Thesis

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ABSTRACT

This thesis explores the similarities and differences between applications of managing software engineering teams in Design Studio and the state of the practice. Information about the leadership structure of Design Studio teams was gathered over 3 semesters of Design Studio experiences with two companies: Hudl and TD Ameritrade. Information about leadership concepts in the state of the practice was gathered from experiences and observations with three different companies: Hudl, Garmin, and TD Ameritrade. From these experiences and observations, it can be concluded that the leadership structure of Design Studio is valuable as a student learning experience, and with proper consideration can be applied to real world applications.

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CHAPTER 1

INTRODUCTION TO DESIGN STUDIO AND LEADERSHIP STRUCTURES

INTRODUCTION

There are many different ways that software engineering teams can be led. Often, students only get to experience software development in a few leadership structures before graduation. Design Studio offers students an opportunity to experience software engineering for real companies in a guided setting. Teams of students communicate with a company sponsor to create software for the sponsor. On top of offering students experience with software engineering, Design Studio also offers students the opportunity to learn leadership and managerial techniques.

Design Studio teams consist of five or six students: two managers, and three or four developers. The two managers are called the Product Manager (further referred to as PM) and Development Manager (further referred to as DM). The PM's role on a Design Studio team is to create and maintain a schedule for the life cycle of the product, as well as communicate and share information with the team's corporate sponsor. The DM's role is to enforce proper development practices and ensure that the project follows any design guidelines and rules set by the sponsor.

The aforementioned structure provides an excellent means for students to learn how to do software engineering. However, is the Design Studio team structure supported by the state of the practice? If not, then why? In this thesis, we will consider the applications of different leadership concepts in both Design Studio and in practice, and why certain leadership techniques work better in each situation.

TYPES OF LEADERSHIP STRUCTURES

To begin discussing the applications of different leadership concepts and structures in software engineering, we must first examine a few different structures. According to Lee Bolman in *Reframing Organizations*, there are several different models of organizing teams: single boss, dual authority, simple hierarchy, and an all-channel network. In a singular boss team model, there is a single manager from whom all information and decisions flow. Figure 1 shows a diagram of this kind of structure. Group members primarily communicate with the main leader, and less with each other. This arrangement is fast and efficient in straightforward situations. However, when circumstances become complicated, the main manager can become overwhelmed and potentially make poor decisions.

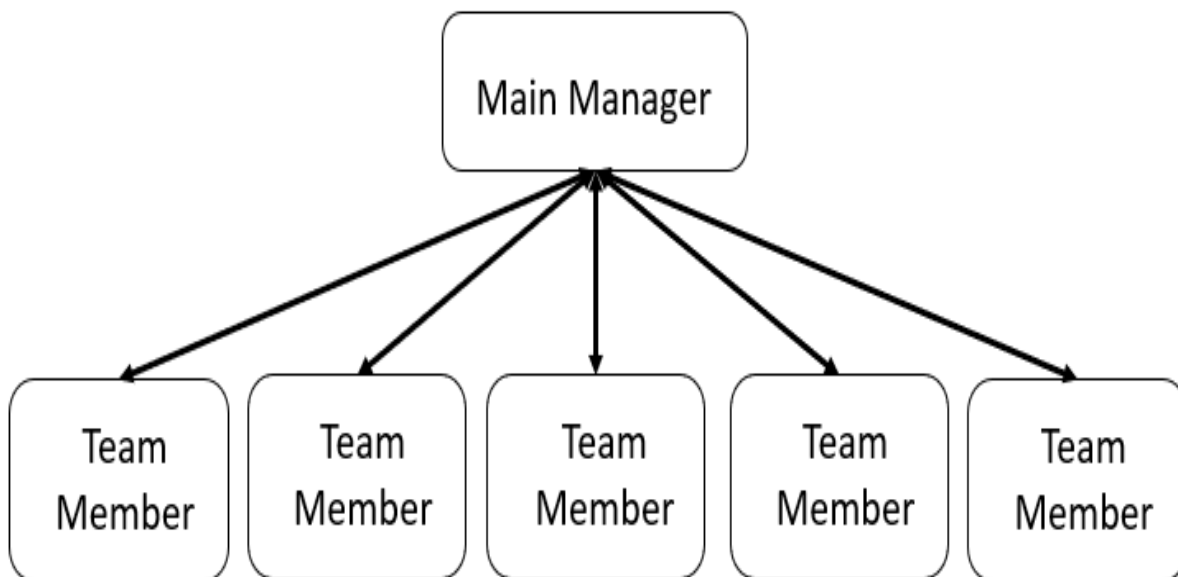


Figure 1: Singular Boss Model

In a dual authority model, two individuals report to a main manager. A diagram representing the dual authority model can be seen in Figure 2 below. Each manager oversees operations of one specific area of concern. This method is effective when tasks are divisible, however the additional layers make communication less efficient.

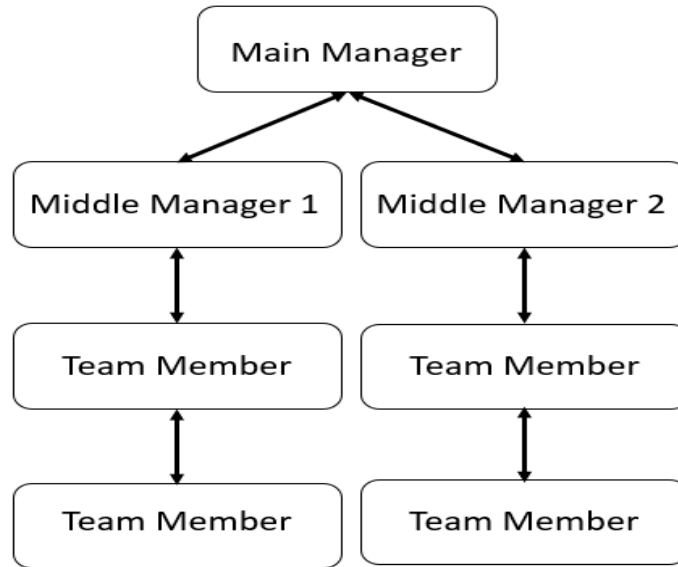


Figure 2: Dual Authority Model

A simple hierarchy places a single manager between the main manager and the subordinates. This structure can be seen in Figure 3. This structure is simpler than the dual authority model, and therefore more efficient. However, there may be friction and conflicts between the middle and main manager.

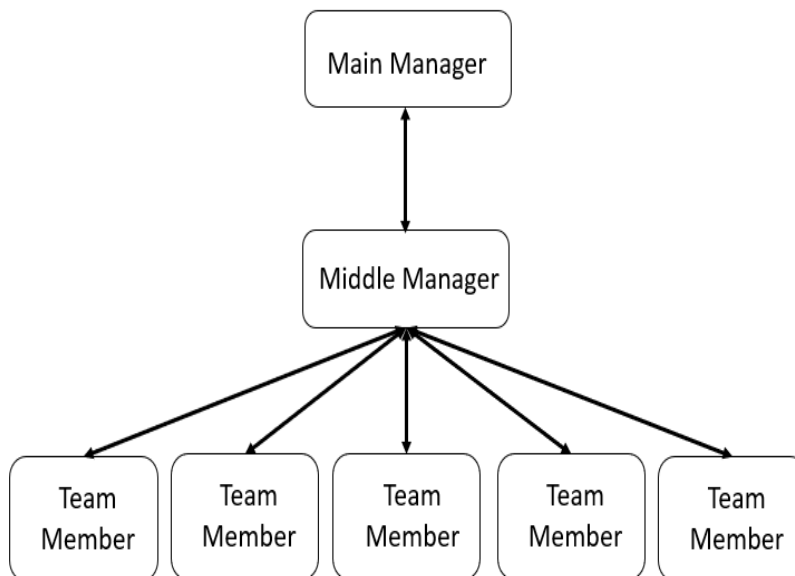


Figure 3: Simple Hierarchy Model

An all-channel network model is a structure in which all group members freely share information and communicate with each other. A diagram representing this model can be seen in Figure 4. This method can produce higher group cohesion among group members and works well when all members enjoy participation and have effective communication skills. However, communication can be slow and inefficient if there are too many group members or there are many disagreements among members.

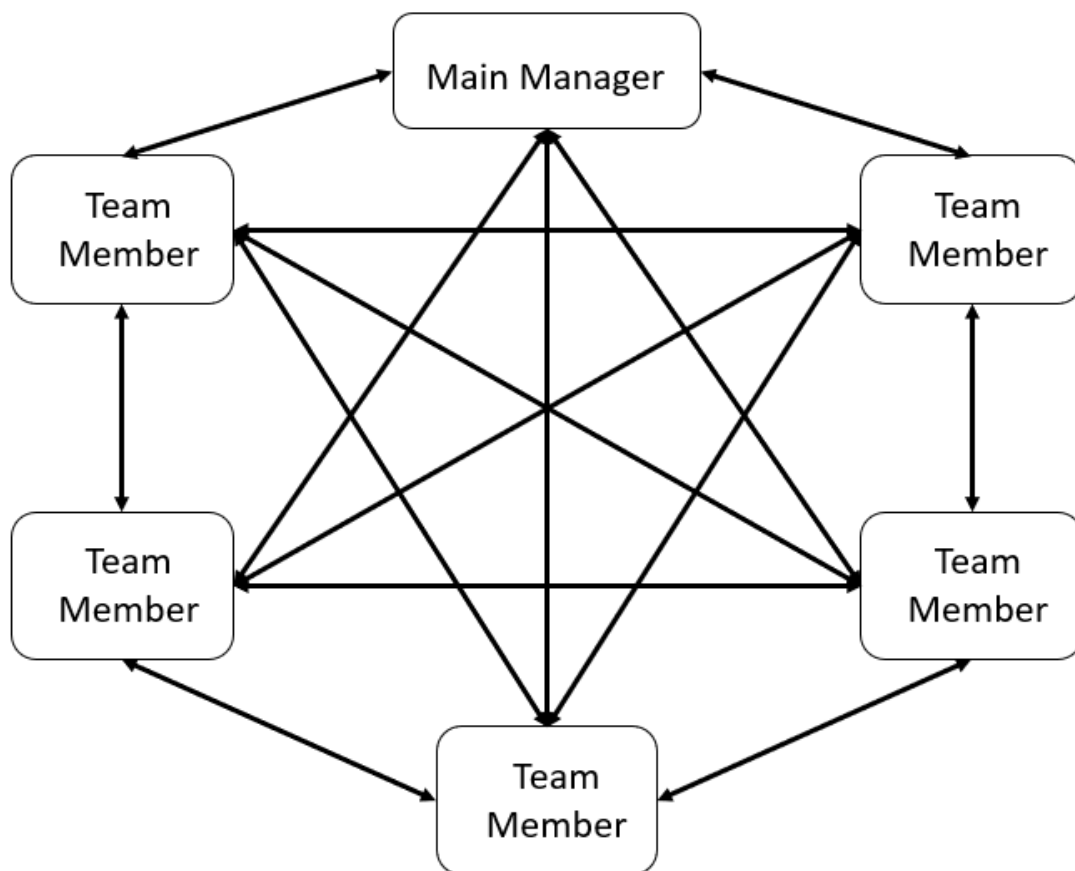


Figure 4: All-Channel Network Model

CHAPTER 2

APPLICATIONS OF LEADERSHIP STRUCTURES

LEADERSHIP STRUCTURES OF DESIGN STUDIO TEAMS

Design Studio teams use parts of all these structures. The singular boss and dual authority are somewhat combined on a Design Studio team. The PM oversees the concern of ensuring the product is well organized, and that communication with the corporate sponsor goes smoothly. The DM is concerned with making sure that the team follows proper development practices and conforms to the development rules and guidelines. This conforms to the dual authority structure. However, the PM and DM often act as a single joint group of authority, to whom the team developers report and communicate. This follows the structure of the singular boss model.

The simple hierarchy and all-channel network model are also used in the structure of a Design Studio team. With the PM and DM acting as a single middle manager, they communicate the instructions from the corporate sponsor to the team, as well as the team's progress to the sponsor. The all-channel network is used during development, when all team members freely communicate with each other to complete the project.

This structure is very effective, at least in Design Studio. This structure offers clearly defined roles of PM, DM and developers, separation of concerns by the PM and DM, and the hierarchies that transform the objectives of the corporate sponsor into tasks that are not overwhelming to developers. This provides a guided, structured means for students to learn real-world software engineering. However, is the multifaceted structure of a Design Studio team necessarily representative of how teams are lead and structured in the practice? This will be investigated in the next section.

LEADERSHIP STRUCTURES IN THE STATE OF PRACTICE

It can be seen that Design Studio teams have aspects of all the different leadership models. However, do software engineering teams in the industry also contain aspects of all the various aspects of these models? Three examples will be discussed to discover why: Hudl, Garmin, and TD Ameritrade. At Hudl, software engineering teams primarily use the single boss and all-channel network models. There is a single PM, but the DM role is nonexistent. Instead, each software engineering team has senior developers that can provide insights about their areas of expertise. The development standards enforcement task of a DM are performed by senior developers on different teams during code reviews.

At Garmin, software engineering teams also utilize the single boss model. Each engineer is assigned a task to complete by the team's manager. Each engineer reports to their manager, who is also an engineer. The manager fulfills both the roles of a PM and a DM, organizing projects and making sure all development on the projects follow Garmin's standards.

Team structure and leadership techniques at TD Ameritrade closely resembles the leadership at Garmin and Hudl. A single boss manages and leads a team of software engineers, with senior developers fulfilling the role of DM. However, TD Ameritrade also uses a simple hierarchy to organize its efforts, as managers report to business segments higher up the chain of command

It can be seen that teams in the industry of software engineering do not apply the same leadership and management concepts as Design Studio teams. But why don't industrial teams follow the same leadership concepts as Design Studio teams? The answer lies in the differing nature of practical software engineering teams and Design Studio teams. The nature of Design Studio and industrial software engineering teams will be discussed in the next section.

CHAPTER 3

NATURE OF SOFTWARE ENGINEERING TEAMS AND CONCLUSION

NATURE OF SOFTWARE ENGINEERING TEAMS

The effectiveness of different leadership concepts for a team depends entirely on the nature of the team. According to *Reframing Organizations*, there are some important questions that must be asked to determine the nature of a team and the appropriate structure:

1. What is the nature and degree of dealings among individuals?
2. What is the spatial distribution of unit members?
3. Where does authority reside?
4. How are efforts integrated?

Each of these questions will be answered regarding both Design Studio and the state of practice to identify the differences between these teams, and why certain leadership structures are more effective in each case.

Nature and Degree of Dealings Among Individuals

The nature and degree of dealing among individuals on a team affects which kind of leadership structure is most appropriate. In a Design Studio team, individuals work together closely to do development, and each piece of communication is of a deeply detailed manner. Therefore, Design Studio teams rely more on an all-channel structure in regard to the nature and degree of communication among peers. In the industrial practice, however, communications with peers may not be as important, as peers may be working on separate assignments. Therefore, communication with managers and leaders is more important in the industrial practice.

Spatial Distribution of Unit Members

The physical spatial distribution of team members also affects which structure is most appropriate for software engineering teams. In Design Studio, all team members are located in the same room, often at the same table. This close physical proximity between group members makes an all-channel communication network to be practical. However, teams may not be spatially close in the industry. At Garmin, for example, individuals on teams may be spread out throughout the building. This makes an all-channel model less natural, and less utilized.

Where Authority Resides

The person or people who hold authority on the software engineering team also changes what structure is most effective. On Design Studio teams, official authority belongs to the sponsors. However, the PM and the DM act on behalf of the sponsors by communicating and actualizing their instructions. This makes a simple hierarchy and dual authority model effective in a Design Studio software engineering team. In the practice, the authority often resides with direct managers, who directly communicate instructions and information with their team members. Thus, a simple hierarchy or singular boss model are more effective for industrial software engineering teams. The structures appropriate for a Design Studio team and a corporate team are very similar when considering placement of authority, that is because in both cases project authority comes from a superior. However, if team decisions were made democratically, that is, each team member had an equal say in product decisions, an all-channel model would be more appropriate: for both Design Studio and practical software engineering teams.

How Efforts are Integrated

Heavily integrated efforts are demonstrated on teams that allocate multiple team members to solve each problem. Design Studio teams tend to be heavily integrated, with multiple

developers working together to solve some tougher problems. Industrial teams tend to only integrate efforts after each individual team member has completed their own work. Therefore, industrial teams are less integrated. Heavier integrated teams benefit more from an all-channel communication model, as communication between members is freer. Lightly integrated teams benefit the most from a single boss structure, because a single manager is all that is needed to make sure efforts are properly integrated.

What can be seen from the above discussion is that Design Studio teams have a slightly different nature than the state of the practice. Therefore, Design Studio teams must apply different leadership structures than the state of the practice. Design Studio teams are heavily integrated, tightly knit, close proximity, and a fairly flat power structure. Therefore, they benefit much from an all-channel structure. However, corporate software engineering teams do not benefit from this all-channel structure but do from the other structures.

CONCLUSION

Design Studio is an excellent learning experience for students. It provides a guided, controlled environment in which students can learn about doing software development in practice.

However, the leadership structure that students experience in Design Studio is different than what students can expect to experience in the state of the practice. This is not a detrimental to the effectiveness of Design Studio, however. The differences in the applications of leadership structures between Design Studio and in practice are born of the differences in nature between the two areas. If students keep that in mind, they will be able to successfully apply the concepts learned in Design Studio in the real world.

REFERENCES

BOLMAN, L. G. (2017). *REFRAMING ORGANIZATIONS*(6th ed.). S.I.: JOHN WILEY & SONS.