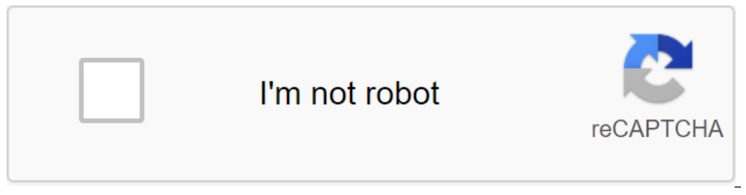

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Architectural patterns in software architecture pdf

The architectural pattern expresses the fundamental pattern of structural organization for software systems. It contains a set of predetermined subsystems, their responsibilities and includes rules and guidelines for arranging relationships between them. An architectural template is a concept that solves and delineates some important cohesive elements of the software architecture. Although the architectural template conveys the image of the system, it is not architecture. This is a common, reusable solution to common problems in the software architecture in this context. Architectural templates are similar to software design patterns, but have a wider reach. Architectural templates address various problems in software development, such as limiting the performance of computer hardware, high availability, and minimizing business risks. Some architectural templates have been implemented within the software. Countless different architectures can implement the same pattern and share te-related characteristics. Patterns are often defined as strictly described and widely available. Figure 1. Source: Data Science: Background: The key aspect of corporate architecture is the reuse of knowledge. In most organizations today, the experience gained in performing similar efforts in the past is rarely used, or grossly inadequate, while dealing with the need today. By making a better use of past experience and knowledge, you can gain significant strategic advantages. Using templates is a great way to reuse knowledge to solve a variety of problems. One of the reasons why experience with similar efforts in the past is rarely used is that problems and solutions are not expressed in a reusable form. Patterns provide a form for expressing technical solutions in the context of business problems and capturing them as reusable corporate knowledge assets. In 1979, (construction) architect Christopher Alexander published The Eternal Path of Construction, which describes how to organize common solutions to architectural problems using patterns. In the early 1990s, software developers began to apply these ideas to system architectures. Here's an example of the multi-level corporate architecture expressed in Alexander format: Name Layering Context (the situation arising from the problem) Systems must evolve to meet the changing demands of users and new technologies Managing changes in complex systems Problem (set of forces, repeatedly arising in context) Applications built as monolithic structures Change one part spreads Changes everywhere Migration timelines long and expensive solutions (configuration to balance forces) System structure in layers Each layer black box with well-defined interfaces Details implementation each each each hidden behind the interface Figure 2 illustrates the layer pattern. Figure 2. Source: MITRE Comparison of Architectural Patterns 4 Layer Pattern Client-Server Pattern Master-Slave Pattern Pipe-Filter Pattern Broker Peer-to-peer Pattern Events-Bus Pattern Model-View-Controller Pattern Blackboard Pattern Translator Pattern Table is shown below summarizes the pros and cons of each architectural template. Figure 3. Source: Vijini Mallawaarachchi Architecture Patterns in Use 5 Two examples of architecture models in use are outlined in the following subsections, one from the field of IT customer enterprise's own architecture structure, and the other from a major system provider who has done a lot of work in recent years in architecture models. 1, the U.S. Treasury Architecture Development Guide (TADG) document (see the U.S. Treasury Architecture Development Guide (TADG)) provides a number of explicit architecture patterns, in addition to explaining the rationale, structure and taxonomy for architectural models as they relate to the U.S. Treasury. The TADG document contains the following patterns. Figure 4. Source: Open Group 2. The IBM Patterns for e-Business website (see IBM e-business templates) provides a range of architecture templates that move from business problems to specific solutions, first at the general level and then on ibm's specific product solutions. An auxiliary resource is IBM's red book set. IBM identifies five types of templates: Business templates that define key business entities, and describe interactions between them in terms of different archetypal business interactions, such as: Service (also as a user to business) - users, Access to Transactions Based on 24x7 Collaboration (also as a User-User) - Users working with each other to share data and information Aggregation information (also as user-to-data) - data from multiple sources aggregated and presented through multiple channels Extended Enterprise (also as a business) - integrating data and processes across the boundaries of enterprise Integration patterns that provide the glue to combine business templates for forming solutions. They characterize a business problem, business processes/rules, and an existing environment to determine whether front or back integration is required. Frontal integration (as well as access integration) is focused on ensuring unhindered and consistent access to business functions. Typical features include one sign-on, personalization, transcoding, etc. back-end integration (as well as application integration) - focused on connecting, interacting or integrating databases and systems. Typical integration can be based on function, integration type, integration and topology. Composite patterns that were previously defined combinations and business choices and templates for previously identified situations, such as: e-commerce solutions, (public) corporate portals, enterprise intranet portal, ASP collaboration, etc. application templates. Each business and integration template can be implemented using one or more application templates. The application template characterizes the rough-grain structure of the application - the main components of the application, the distribution of processing functions and interactions between them, the degree of integration between them and the placement of data in relation to applications. Execution patterns. Application templates can be implemented using run time templates that demonstrate non-functional service level characteristics such as performance, capacity, scalability, and availability. They identify key resource constraints and best practices. Architectural styles versus architectural patterns versus design patterns it is important to reinforce the idea that architectural styles, architectural patterns and design patterns are not mutually exclusive, they complement each other, although, they should only be used when necessary. The key difference is the scope. Architectural styles tell us, in very broad strokes, how to organize our code. This is the highest level of detail, it shows layers, high-level application modules and how these modules and layers interact with each other, the relationship between them. The template is a recurring solution to a recurring problem. In the case of architectural patterns, they solve problems related to architectural style. For example, what classes we will have and how they will interact, in order to implement a system with a certain set of levels, or what high-level modules will have in our service-oriented architecture and how they will communicate, or how many levels will have our client server architecture. Architectural patterns have a significant impact on the code base, most often affecting the entire application either horizontally (e.g., how to structure code within the layer) or vertically (e.g., how the request is processed from the outer layers to the inner layers and back). Design patterns differ from architectural patterns in scope, are more localized, they have less impact on the code base, they affect a particular section of the code base, such as: (a) How to instantly use an object when we know only what type should be instantly connected during time time time (perhaps a factory class?); b) How to make an object behave differently depending on its condition (perhaps a state machine or a strategy pattern?). In conclusion: Architectural style is the design of the application at the highest level of abstraction; An architectural template is a way to implement architectural style; Design pattern how to solve a localized problem. In addition, the template can be used as a quality A pattern or design pattern, again depending on the scope in which we use it, in a particular project. See Also Architectural Style Architectural Principles Architectural Risk Architecture Description Language (ADL) Architecture Development Method (ADM) Architecture Modernization Driven Service Oriented Architecture (SOA) Software Architecture The Open Group Architecture Framework (TOGAF) Design Pattern Enterprise Architecture References Further Reading When I was attending night school to become a programmer, I learned several design patterns: singleton, repository, factory, builder, decorator, etc. What I didn't learn is that a similar mechanism exists at a higher level: software architecture patterns. These are templates for the overall layout of an app or application. All of them have their advantages and disadvantages. And they all deal with specific issues. The layered pattern of layered template is probably one of the most well-known patterns of software architecture. Many developers use it without knowing its name. The idea is to divide the code into layers where each layer has a certain responsibility and provides a service to a higher level. There is no predetermined number of layers, but these are the ones you see most often: The presentation or user interface layer of the Application Layer Business or Domain Layer Perseverance or the level of access to the data layer of the database layer Idea is that the user initiates a portion of the code in the presentation layer by performing certain actions (such as pressing a button). The view layer then triggers a base layer, i.e. the application layer. Then we go into the business layer and finally the level of perseverance keeps everything in the database. Thus, the higher layers depend on and make calls to the lower layers. You'll see variations of this, depending on the complexity of the apps. Some apps may omit the application layer, while others add a caching level. You can even combine two layers into one. For example, the ActiveRecord pattern combines layers of business and perseverance. As mentioned, each layer has its own responsibility. The presentation layer contains the graphic design of the app, as well as any code to process user interaction. You should not add logic that is not user-specific in this layer. The business layer is where you put the model and logic that is specific to the business problem you are trying to solve. The application layer is between the presentation layer and the business layer. On the one hand, it provides abstraction, so the level of view should not know the business layer. Theoretically, you can change the presentation level technology stack without changing others in the app (for example. (e.g. from WinForms to WPF). On the other hand, the application layer provides a place to introduce a certain coordination logic that doesn't fit into the business or presentation layer. Finally, the save layer contains a code to access the database layer. The database layer is the main technology of the database (e.g. S'L Server, MongoDB). The Save layer is a set of code to manage the database: SDL statements, connection information, etc. It's an easy way to write a well-organized and testable application. Disadvantages This usually leads to monolithic applications that are difficult to separate afterwards. Developers often write a lot of code to get through different layers without adding any value to these layers. If all you do is write a simple CRUD app, a layered template may be redundant for you. Perfect for standard business applications that do more than just CRUD microkernel template operations, or a plug-in template, is useful when your app has a core set of responsibilities and a collection of interchangeable pieces on the side. The microkernel will provide the entry point and the overall flow of the application without knowing what the various plug-ins are doing. An example would be a task planner. Microkernel can contain all the logic of scheduling and running tasks, while plugins contain specific tasks. As long as plug-ins stick to a predetermined API, the microkernel can cause them to know the details of the implementation without having to know the details of the implementation. Another example is the workflow. Implementation of the workflow contains concepts such as the order of the various steps, the evaluation of steps, the decision on the next step, etc. The benefits of this model provide greater flexibility and extensibility. Some implementations allow you to add plug-ins while the app is running. Microkernel and plug-ins can be developed by individual teams. Disadvantages It can be difficult to decide what belongs in the microkernel and what is not. A predetermined API may not be a good fit for future plugins. Ideal for applications that take data from different sources, convert that data and write it down into various Task Assignment WorkFlow applications and C'RS work planning applications is an acronym for segregation of command and query responsibility. The basic concept of this template is that the application is reading operations and writing operations that need to be completely separated. This also means that the model used to record operations (commands) will be different from the reading (requests) models. In addition, the data will be stored in different locations. In the relational database, this means that there will be team model and tables for the reading model. Some implementations even store different models in completely different databases, such as the S'L server for the team model and MongoDB for the reading model. This model is often combined with the search for events that we will cover below. How exactly does it work? When a user takes action, the app sends the command to the command service. The command service extracts any data it needs from the command database, makes the necessary manipulations and stores it back into the database. It then notifies the reading service so that the reading model can be updated. You can see this thread below. When an app needs to show the data to the user, it can get a reading model by calling the reading service, as shown below. Advantages Command models can focus on business logic and verification, while reading models can be adapted to specific scenarios. You can avoid complex queries (such as joining S'L), making reading more fulfill. The disadvantages of keeping commands and reading patterns in sync can be tricky. Ideal for applications that expect a large number of reads of applications with complex Sourcing Event domains as I mentioned above, C'RS often goes hand in hand with event sources. This is a pattern in which you keep not the current state of the model in the database, but the events that occurred with the model. So when a customer's name changes, you won't keep the value in the Name column. You'll keep the NameChanged event with a new value (and maybe the old one too). When you need to get a model, you extract all of its saved events and reapply on them at the new object. We call it object rehydration. The real analogy of event sources is accounting. When you add a cost, the value of the amount does not change. A new line with the operation is added to the accounting. If a mistake has been made, you simply add a new line. To make your life easier, you can calculate the total number each time you add a string. This amount can be considered as a reading model. Bringing the example below should make it clearer. You can see that we made a mistake in adding the 201805 invoice. Instead of changing the line, we added two new lines: first one to undo the wrong line, then a new and correct line. That's how event search works. You never delete events because they have undoubtedly happened in the past. To fix the situation, we add new developments. Also, note how we have a cell with a total cost. It's just the sum of all the values in the cells above. In Excel, it's automatically updated so you can tell it's in sync with other cells. It's a reading model that provides a light For the user. Event sources are often combined with C'RS because object rehydration can have an impact on performance, especially when there are many events for the instance. Fast Reading Model significantly improve your app's response time. The benefits of this template software architecture can provide a log audit out of the box. Each event is a manipulation of data at a certain point in time. Disadvantages This requires some discipline because you can't just fix the wrong data with simple editing in the database. Changing the structure of an event is not a trivial task. For example, if you add a property, the database still contains events without that data. Your code will have to process these missing data kindly. Ideal for applications that should publish events for external systems to be built with C'RS have complex domains Need a log of audit changes in Microservices data When you write an application in the form of a set of microservices, you will actually write multiple applications that will work together. Each microservice has its own special responsibility, and teams can develop them independently of other microservices. The only dependence between them is communication. As microservices communicate with each other, you should make sure that the messages sent between them remain compatible on the other side. This requires some coordination, especially when different groups are responsible for different microservices. The diagram can explain. In the diagram above, the app calls a central API that directs the call to the correct microservice. In this example, there are separate services for the user profile, inventory, orders, and payments. You can imagine that this is an app where the user can order something. Individual microservices can also call each other. For example, the payment service may notify the order service when the payment is successful. The order service can call the inventory service to adjust inventory. There is no clear rule on how big a microservice can be. In the previous example, the user profile service may be responsible for data such as username and password, as well as home address, avatar image, favorites, etc. The benefits of writing, maintaining, and deploying each microservice separately. Microservice architecture should be easier to scale because only microservices that need to be scaled up can be scaled. There is no need to scale the less frequently used parts of the application. It's easier to rewrite parts of the app because they're smaller and less related to other parts. Disadvantages Contrary to what you might expect, it's actually easier to write a well-structured monolith at first and divide it into a microservice later. With microservices, a lot of additional problems come into play: communication, backward compatibility, logging, etc. Teams that lack the necessary skill to write a well-structured monolith are likely to be difficult writing a good set of microservices. One user's action can go through several microservices. There are more failure points, and when something goes wrong, it may take longer to identify the problem. Ideal for: Applications where some parts will be used intensively and should be scaled by services that provide functionality for several other Application applications that will become very complex if combined into one monolith of applications where a clear limited context can be defined by The Combine I explained several software architecture patterns as well as their pros and cons. But there are more templates than the ones I've outlined here. It is also not uncommon to combine a few of these models. They are not always mutually exclusive. For example, you can have multiple microservices and use a tiered template, while others use C-RS and event sources. It is important to remember that there is no solution that works everywhere. When we ask what template to use for the application, the age-old answer still applies: It depends. You have to weigh the pros and cons of the decision and make an informed decision. 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