The latest developments in advanced architectural patterns: a survey

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***Abstract*—In this document, the common software architectural patterns are brifely discussed. The document further describes latest advancements in service oriented architecture, microservices, reactive programming and resilient software development.**

***Index Terms*—SOA, microservice, reactive programming, resilient software**

I. Architectural design patterns

Large enterprise needs software that scales with ever chaging and increasing needs of the business. Selecting the right architecture before diving into the actual work is crucial to the success of the application and enterprise. This section explores various architectural patterns used in the industry. The pros and cons will be discussed for each of the pattern.

A. Layered architecture

It is the most common architecture style, that organize similar modules into horizontal layers. The layers are independent of others and inteact using exported APIs. An application can be designed using any number of layers. The network protocol stack is a good example of layered architecture. The in upper layer is transmitted to lower layers using encapsulated packets. A layer don't have to know the inner working of other layer and communication happens through a set of APIs exposed by each layer. Another example of bussiness application, that is divided into presentation, logic and data tiers. Following of some of the benefits offered by this architecture.

- Layers can be developed and tested independently.
- Changes made in one layer doesn't affect the other layer, hence maintainable.
- Low coupling and high cohesion
- Lower layers have no dependency on higher layer and hence reusable.

The disadvantages can be summarized as follow.

- A change to any component may trigger a redeployment of the entire application.
- Each layer can have separate physical deployment or an entire application can be replicated. It is too coarse grained from deployment perspective.
- Communication across layers can be a performance bottleneck for certain applications.

B. client-server architecture

It consists of a server and multiple clients. The server keeps listening to the client requests. The server responds to any new client requests i.e., provides a service to those clients. E.g. the encryption key control server provides encryption keys to the requesting clients over network. This model is prone to denial of service attack. The scalability requires replicating the server components with load balancing, failover and failback mechanisms.

C. Pipe and filter architecture

This approach is suitable for large applications that can be broken down to multiple steps. Each step refers to a filter. The filter applies a specific function to the data and can work asynchronously as well. The pipes refer to the connectors between these filters. The output of one filter serves as an input for the next filter on the pipeline. The common example is Unix pipes.

- Adding a new step is easy by adding a new filter and adding it to existing pipe stream.
- It is easier to reuse of filters doing generic actions.
- Promotes concurrency of different filters do not depend on each other.
- The errors gets propogated across the filters, which is a downside of this architecture.
- A broken filter leads to complete broken pipe.

D. Peer to peer architecture

E. Blackboard

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Define abbreviations and acronyms the first time they are used in the text, even after they have been defined in the abstract. Abbreviations such as IEEE, SI, MKS, CGS, ac, dc, and rms do not have to be defined. Do not use abbreviations in the title or heads unless they are unavoidable.

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Number equations consecutively. To make your equations more compact, you may use the solidus (/), the exp function, or appropriate exponents. Italicize Roman symbols for quantities and variables, but not Greek symbols. Use a long dash rather than a hyphen for a minus sign. Punctuate equations with commas or periods when they are part of a sentence, as in:

$$a + b = \gamma \tag{1}$$

Be sure that the symbols in your equation have been defined before or immediately following the equation. Use "(1)", not "Eq. (1)" or "equation (1)", except at the beginning of a sentence: "Equation (1) is . . ."

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Please use "soft" (e.g., `\eqref{Eq}`) cross references instead of "hard" references (e.g., `(1)`). That will make it possible to combine sections, add equations, or change the order of figures or citations without having to go through the file line by line.

Please don't use the `{eqnarray}` equation environment. Use `{align}` or `{IEEEeqnarray}` instead. The `{eqnarray}` environment leaves unsightly spaces around relation symbols.

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- In your paper title, if the words "that uses" can accurately replace the word "using", capitalize the "u"; if not, keep using lower-cased.
- Be aware of the different meanings of the homophones "affect" and "effect", "complement" and "compliment", "discreet" and "discrete", "principal" and "principle".
- Do not confuse "imply" and "infer".
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- There is no period after the "et" in the Latin abbreviation "et al.".
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An excellent style manual for science writers is [7].

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Component heads identify the different components of your paper and are not topically subordinate to each other. Examples include Acknowledgments and References and, for these, the correct style to use is "Heading 5". Use "figure caption" for your Figure captions, and "table head" for your table title. Run-in heads, such as "Abstract", will require you to apply a style (in this case, italic) in addition to the style provided by the drop down menu to differentiate the head from the text.

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TABLE I
TABLE TYPE STYLES

Table Head	**Table Column Head**		
	Table column subhead	***Subhead***	***Subhead***
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[a]Sample of a Table footnote.

Figure Labels: Use 8 point Times New Roman for Figure labels. Use words rather than symbols or abbreviations when writing Figure axis labels to avoid confusing the reader. As an example, write the quantity "Magnetization", or "Magnetization, M", not just "M". If including units in the label, present them within parentheses. Do not label axes only with units. In the example, write "Magnetization (A/m)" or "Magnetization {A[m(1)]}", not just "A/m". Do not label axes with a ratio of quantities and units. For example, write "Temperature (K)", not "Temperature/K".

Fig. 1. Example of a figure caption.

ACKNOWLEDGMENT

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REFERENCES

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Unless there are six authors or more give all authors' names; do not use "et al.". Papers that have not been published, even if they have been submitted for publication, should be cited as "unpublished" [4]. Papers that have been accepted for publication should be cited as "in press" [5]. Capitalize only the first word in a paper title, except for proper nouns and element symbols.

For papers published in translation journals, please give the English citation first, followed by the original foreign-language citation [6].

REFERENCES

[1] G. Eason, B. Noble, and I. N. Sneddon, "On certain integrals of Lipschitz-Hankel type involving products of Bessel functions," Phil. Trans. Roy. Soc. London, vol. A247, pp. 529–551, April 1955.
[2] J. Clerk Maxwell, A Treatise on Electricity and Magnetism, 3rd ed., vol. 2. Oxford: Clarendon, 1892, pp.68–73.
[3] I. S. Jacobs and C. P. Bean, "Fine particles, thin films and exchange anisotropy," in Magnetism, vol. III, G. T. Rado and H. Suhl, Eds. New York: Academic, 1963, pp. 271–350.
[4] K. Elissa, "Title of paper if known," unpublished.
[5] R. Nicole, "Title of paper with only first word capitalized," J. Name Stand. Abbrev., in press.
[6] Y. Yorozu, M. Hirano, K. Oka, and Y. Tagawa, "Electron spectroscopy studies on magneto-optical media and plastic substrate interface," IEEE Transl. J. Magn. Japan, vol. 2, pp. 740–741, August 1987 [Digests 9th Annual Conf. Magnetics Japan, p. 301, 1982].
[7] M. Young, The Technical Writer's Handbook. Mill Valley, CA: University Science, 1989.

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