# RFC IN APPROACH MODEL PARADIGM

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**Abstract:** The problem area in this paper relies on proposed approach model paradigm. According to this paradigm the networking system development process follows an abstract hierarchy approach, which defines logical hierarchical place of RFC approach and networking system development phase. The applied analysis and formed conclusions were based on the proposed here paradigm.

**Key words:** network system development, system approach, RFC

## 1. INTRODUCTION

The system development process has solid period of time to evolve, including development of networking systems. With the approximate time of period RFC technology has formed its fundamental traits as well. One of the main characteristics of RFC operations were determined by the Defense Advanced Research Projects Agency later taken under the steering of Internet Society under contract with the Internet Engineering Task Force Administration Limited Liability Company. As main organization Internet Engineering Task Force (IETF) is involved for standards development through published RFCs that describe Internet protocols and specifications [1, 2].

According to its steering body the RFC series could be separated in two main domains: Technical and Organizational with main features:

- *Documents about the global data network (Internet);*
- *Specifications and policy documents.*

These features are related to the following topics [3]:

- *Computer networking;*
- *Protocols, procedures, programs, and concepts.*

This paper puts under consideration the explicit status of the RFC approach, its characteristics and bindings to the networking system development as a part of networking system development process.

The problem area, outlined by probably ambiguity or lack of unconditional understanding, as technical imperative of the RFC approach methodology, could

leads to misguided conclusions in certain cases. All circumstances above formed the reasonable checkpoint questions:

1. Is RFC a system approach?
2. Does RFC correspond to technology?
3. Does RFC correspond to the concept of system development?
4. Are these RFCs, act as a framework for system design documents?
5. Are these RFCs prescriptive norms?
6. Are principles of system design applicable for developing a protocol specification?
7. Are these RFCs represent only details?

To give answers and to clarify aspects of the problematic field in this paper will be presented systematic point of view.

## 2. THE PROBLEM AREA

To be precise and correct there should be common accepted understanding of what the term system (networking) development is. There is basic features set, determining system (networking) development [4-9, 12]. According to priors this set is presented in the Table 1. Due to RFC domain definition the term "networking system development" will be used further as system development derivation.

*Table 1. Basic features set, determining networking system development*

| ***N*** | ***Features*** |
|---|---|
| *1* | *Intended to systems* |
| *2* | *Includes technical requirements* |
| *3* | *Comprises basic architectures* |
| *4* | *Conformance to standard formats* |
| *5* | *Includes protocols* |
| *6* | *Conformance to methods and procedures* |
| *7* | *Includes models* |
| *8* | *Conformance to technical decisions* |
| *9* | *Produces documents* |
| *10* | *It is technical deliverable* |
| *11* | *Enables interdisciplinary engineering activity** |
| *12* | *It is time consuming* |

* Note: It is theoretical but there should be regarded specific networking system development in every approach and thus should be classified as monodisciplinary.

Having more than four decade evolution for the system development processes it is possible to summarize its main phases and stages [11]. But there is one key factor when networking system has to be developed – the inclusion of

RFCs. In a modern development concept more evidence of advantages of using RFCs became a good practice. Such RFC driven development approach emphasis on technical decisions and implications [13, 14]. In point of view of networking system development and RFC implication on it at the Figure 1 a full workflow process is presented.

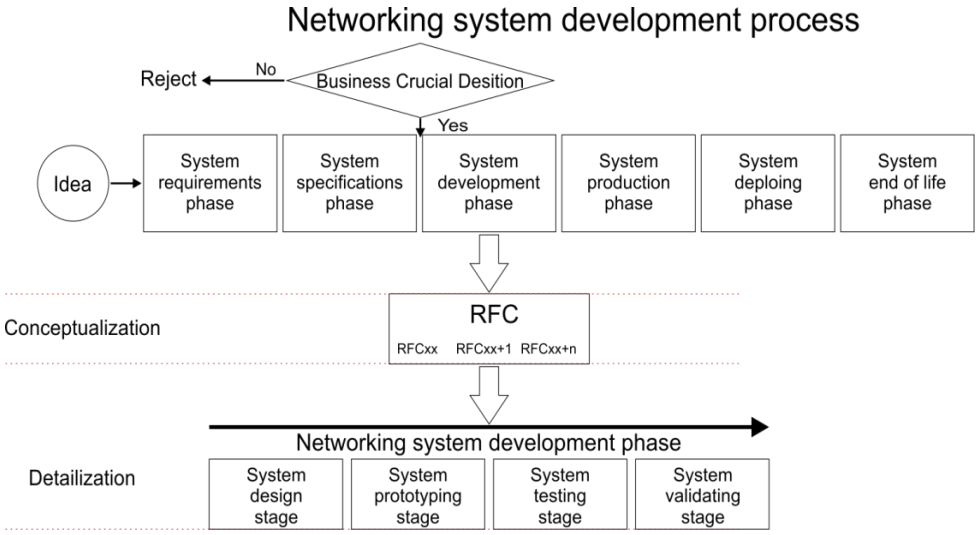


*Fig.1. Networking system development process workflow*

To proceed with defining main RFC approach characteristics it is need to follow checkpoint seven key questions presented above.

To question 1: As with the common definition of networking system approach, comprising applications of analytical, mathematical, and scientific principles[17, 18] to formulating, proposing, and developing a solution at the acceptable risk, including user satisfaction and needs throughout entire development life cycle at minimum cost – there is a simple examples (RFC6108, RFC8374)[10], which provides logical analog to the above definition as critical end-user notifications, satisfying user needs, proposed deployment and solution, and all this at minimum costs.

To question 2: The modern practice of including RFC as leading and successful technical approach is straightforth [13, 14].

To question 3, 4 and 6: There are explicit traits of networking system development in various RFC entries such as RFC6108, RFC5218, RFC6709 [10] and in [15, 16] and at Fig 1 as well. Seeking logically reasoning, this could be formulated with the predicate logic:

Let $\rho_i \in R = \{\rho_1, \rho, \dots \rho_n\}$,

Where: $R$ – set of all RFC database entries; $\rho_i$ – i$^{-th}$ entry of the RFC database

So we could accept that:

$$\exists\,(\rho_i) \rightarrow (P(NetSysDev) > 0 \,\forall\, (\rho_n : R)\; for\; i = 1..n \,\forall\, n > 0,$$

Where: $P$– Possibility of valid networking system development approach; $NetSysDev$ – is networking system development approach

So, in other words, there is at least one RFC database entry on which norms the arbitrary networking system could be developed.

To question 5: The meaning of RFC should be regarded in point of its normative characteristic. There are two main rules classes in this point of view. These are prescriptive and descriptive rules. An approach with prescriptive rules should be controlled by an official body that determines what is or is not legal in normative meaning. This is slightly modified understanding, exposed in [9]. On the other hand descriptive rules is one which rely on understanding other practice (often good one), but without obligated following.

To question 7: This question defines the scope of the RFC, rather argues its class as holistic or as certain detail characteristic. Here, the approach accepted to analyze the class of RFC, was based on the type of the issued (produced) as an output in RFC. Brief analysis shows that more than 80% of these RFC entries fall in the class of strong holistic - such as protocols and standards. The remaining ones RFC entries reviewed as methods, procedures and formats have to be holistic to be valid in their future implementations, based on these RFCs.

Thus, having the exposed above a compact study and analyzing of the RFC will be needed to construct the model approach. A brief content analysis of the RFC titles would produce results shown at the Figure 2.

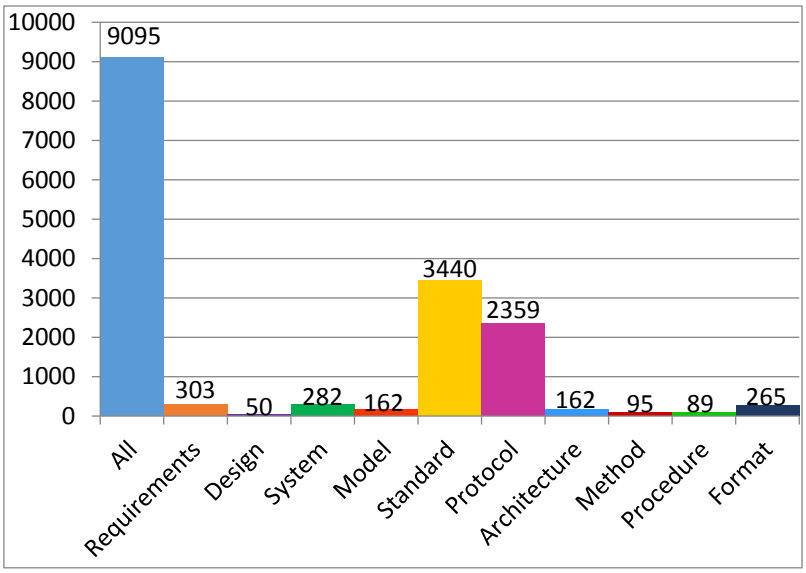


*Fig. 2. Brief content analysis of the RFC entries conformed to Table 1*

In the current RFC database set there is direct conformance between networking system development features and RFC content features. Because of amount of RFC entries, accepted approach will rely upon the conformance between RFC titles and its content. As a source of RFC is data from [10]. It is important to notice that the above presented distribution (Fig.2) is a result of straightforward bind with used terms for classification the networking system development category (Table 1). As stated above, the networking system development approach has basic features set which are straightforward related with RFC approach. To resolve this, an approach model paradigm was synthesized, presented at Figure 3.

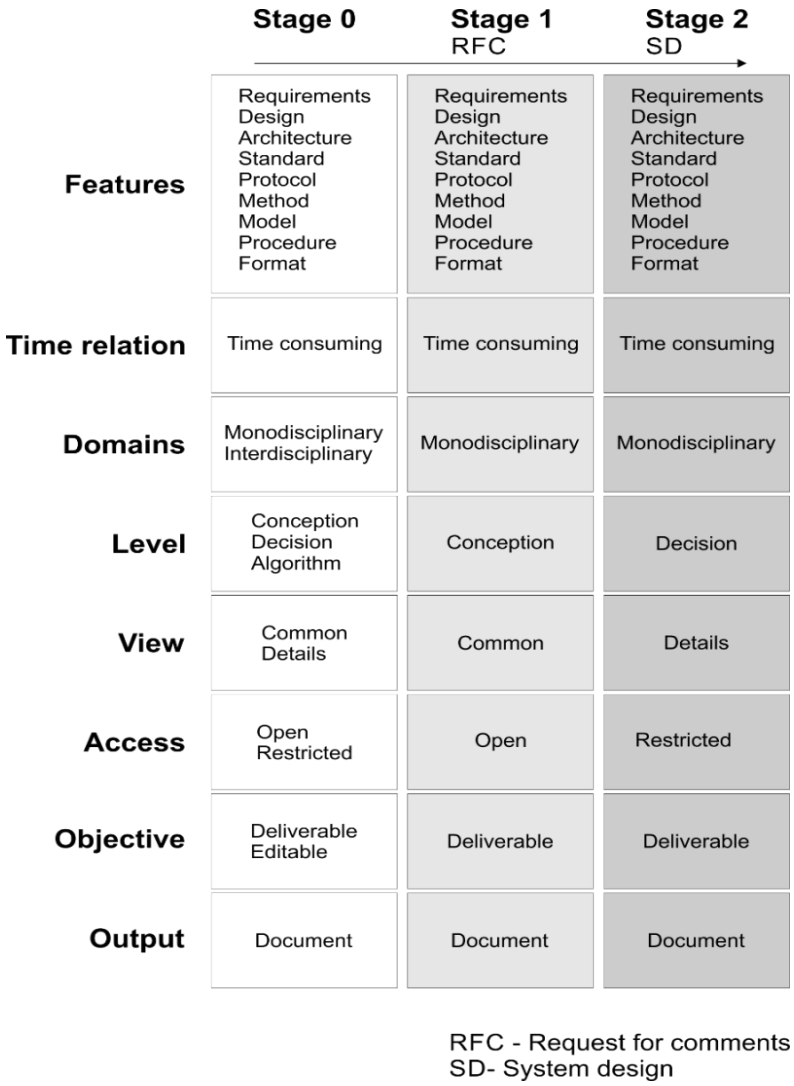


*Fig. 3. Approach model paradigm*

And as a logical step, in this paper the following assumptions were accepted:

- The features of the RFC could map directly to the features in a system design or vice versa;
- There is time-hierarchical organization in approach model paradigm (Fig.3) by meaning from common to specific;
- The RFC approach conceptualizes system design approach.

The presented paradigm in Fig.3 implies proving of statement claimed that networking system design approach is lower level activity, conceptualized by RFC. The noted derived differences designated in the Fig.3 approaches are inheritable related and following object-oriented modeling. Following the approach model paradigm, the derived differences are determined by model logic.

This logic defines three stages in the approach of networking system development. In the first one stage or stage zero, the object definition could be accepted as a base abstract inheritable object. In the stage 1 the definition of the object should be regarded as an inherited object of stage zero. Evolving this conception, in the stage 2 the definition of the object inherits definition in the stage 1. As object-oriented approach implies, there is possibility of polymorphism there. Following this logic, there is enough reason to claim that there is common logical bind meaning of components in the stage 1 and stage 2. It is important to be noted, that approach model paradigm evolves its conception in pseudo-vertical and strong time-hierarchical(horizontal) direction. Following the pseudo-vertical direction as an output in the form of document is produced. As model paradigm suggests, every output has been produced by own set of components. This is valid only for stages 1 and 2 as stage zero has an abstract nature. The second important thing in the proposed model of approach paradigm is the circumstance, that the general set of ***features*** in the all stages is identical. This is key characteristic of the proposed model and outlines the problem defined area.

To add more truthiness when resolving this problematic case, in this paper are involved two variables - "approach"(independent) and "feature"(dependent) both of categorical (nominal) type. The applicable technique in this case is Chi-square test for independence.

Based on the above as a source of data, a statistical Chi-square test was conducted in the following conditions:

1. Direct feature map (Table 2);
2. A categorical type is used for independent and dependent variables;
3. The significance level of $\alpha = 0.05$;
4. Accepted hypotheses:

   $H_0$: There are no statistically significant differences between RFC approach and networking system development approach.

   $H_1$: There are statistically significant differences between RFC approach and networking system development approach.

*Table 2. Direct map of features set of RFC approach and networking system development**

| ***Approach*** | ***Features set*** |
|---|---|
| ***RFC*** | *Requirements* |
| | *Design* |
| | *Architecture* |
| | *Standard* |
| | *Protocol* |
| | *Method* |
| | *Model* |
| | *Procedure* |
| | *Format* |
| | *Document* |
| | *Deliverable* |
| | *Monodisciplinary* |
| | ***Conception*** |
| | ***Common*** |
| | *Time consuming* |
| | ***Open*** |
| ***System design*** | *Requirements* |
| | *Design* |
| | *Architecture* |
| | *Standard* |
| | *Protocol* |
| | *Method* |
| | *Model* |
| | *Procedure* |
| | *Format* |
| | *Document* |
| | *Deliverable* |
| | *Monodisciplinary* |
| | ***Decision*** |
| | ***Details*** |
| | *Time consuming* |
| | ***Restricted*** |

* Note: Highlighted features, presented in the table, in both approaches have no matches.

According to the result of the Chi-square test (Table 3) the $\chi^2_{emp} < \chi^2_{\alpha}$ with $\chi^2_{\alpha} = 28.869$ , then the null hypothesis is not rejected. In other words, both approaches - RFC and networking system development follow same model logic.

*Table 3. Result from the Chi-square test*

| ***Statistic*** | ***Statistics: Feature (18) x Approach (2)*** | | |
|---|---|---|---|
| | *Chi-square* $\chi^2_{emp}$ | *Degree of freedom df* | *p* |
| ***Pearson Chi-square*** | *6.000000* | *df=18* | *p = 0. 99620* |
| ***M-L Chi-square*** | *8.317766* | *df=18* | *p = 0. 97352* |

## 3. CONCLUSION

As a general conclusion could be made that the RFC approach should be classified as a technical in the field of computer networking with clear and prescriptive normative. Main characteristic of these RFC approach implies conceptualization and holistic pattern to follow. In semantic plan a short definition of the RFC could be made – *system based, conceptual, technical related, prescriptive norms and holistic view*.

There is also an approach model paradigm synthesized, through which the functional role and hierarchical phase of RFC was determined in the networking system development process.

With such characterization, an approach of common conceptualization and modelling should be applied to ensure the proper networking system development. And, finally including the RFC in the network development process could be regarded as an approach with wide range of high level expertise at minimal costs.

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