Methodology for Network Design Based on ITIL v3 Practices

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Resumen

El contar con una infraestructura de red que permita mantener de manera confiable y segura estos servicios se ha vuelto algo de primera necesidad para las empresas e instituciones. Pero poder diseñar una red que genere valor para estas sin tener ningún punto de referencia, no es tarea fácil. Con este trabajo de investigación se propone una metodología para realizar el diseño de una infraestructura de red adecuada, utilizando ITIL v3 como un marco de referencia de buenas prácticas, lo cual, generara un valor agregado para cualquier proyecto de esta índole. Los procesos para el diseño de una red con un enfoque en ITIL permite una mejor comunicación entre el área de TI y los usuarios finales, generando un amplio entendimiento de la red y con ello realizar un diseño adecuado que se ajuste a las necesidades de la empresa o institución.

Abstract

Having a network infrastructure that allows to those services to be reliably and securely maintained has become a primary need for the companies and institutions. So being able to design a net-work that generates value for them without having any point of reference is not an easy taskat all. With this research work, a methodology is proposed to carry out the design of an adequate net-work infrastructure, using ITIL v3 as a reference framework of good practices, which will generate added value for any project of this nature. The processes for the design of a network with a focus on ITIL allows better communication be-tween the IT area and the end users, generating a broad understanding of the network and thus making a suitable design that fits to the needs of the company or institution.

Palabras clave: servicio, metodología, diseño, buenas prácticas.
Keywords: service, methodology, design and good practices.

1. INTRODUCTION

In every network project the analysis of the infrastructure, the components of Tan-to software and hardware, resources from materials to humans gives the capacity to offer the essential starting point for the next phase. This analysis must be able to offer a detail understanding of the needs for the company or institution, otherwise the project would not be successful, generating considerable loss of resources and impairing the requirements of the objectives set by these.

The design

According to the Royal Spanish Academy in its second meaning, the design word is defined as: project, plan that configures something. To expand this meaning, it can be added that by design the art of projecting the aspect, The function and production of a functional object by graphic signs, whether it is a two-dimensional object (spectaculars, logos, animations, covers, etc.) or three-dimensional (buildings, machineries, furnitures, among others).

The design has been assimilated in almost all human disciplines, from art to engineering, allowing the development of methodologies for carrying out projects with better results and a higher quality, so to design

something it needs, research, analysis, modeling and adaptations are needed up to the definitive start-up of the project.

Data Network Design

The meaning data network refers to a set of independent computer systems connected to each other, in a way that makes possible an exchange of data and resources, which is why both the logical and physical connection of the systems is necessary.

To design the network is the next step to realize after having made a thorough analysis of the situation in which the company or institution where the project will be carried out finds itself. In this analysis, it must be clear, as mentioned before, several important points to adequately address the problem, such as the classification of the company, the identification and priority of each of its needs, leaving as evidence a detailed documentation to consult if you have problems with the client or the requirements, even if the objectives for which the project is carried out are overlooked.

Some points to consider when starting any design of a data network are: list the objectives that must be completed, determine what changes or additions are necessary to meet these, decide the technical requirements necessary to implement the network, determine the way in which technical requirements will be met and which of all the above elements must be present in the final design.

Two other important points to consider are: the management of restrictions and the realization of compensations. Both terms have to do with the other.

Constraints are nothing more than requirements that cannot be ignored in the design, leading the network designer to analyze all the alternatives that can be found and select the most suitable ones to include in the final design.

The realization of trade-offs allows an exchange between the ideal and the realistic in a project, the restrictions usually require trade-offs between the benefits and the time or cost, which makes the designer's work focus on minimizing the effects that these may cause. in the main objectives of scalability, availability, security and easy of administration.

ITIL V3

Information Technology Infrastructure Library (ITIL) is a Service Management best practice framework.

The framework was adopted by large companies and European governments, which spurred its development. In 2007 ITIL version 3 was released in the form of 5 publications (one for each phase of the life cycle), containing 26 processes and 4 functions.

ITIL provides a base of guidelines for the design of services that can be applied to any information technology project, including the design of a data network, although it also allows better management of resources, planning, control, recording and analyze the network data, improving the quality of the service it offers to the institution and the fulfillment of its objectives.

This research seeks to propose a methodology for the design of data networks, taking as a reference the ITIL process model.

Another of the purposes of this work is to provide a point of reference when undertaking projects that involve the design or restructuring of networks. In the same way, it is derived from the professional project of the master's degree in IT: Design prototype and improvement of the computer network infrastructure of the Secretariat for Economic Development and Competitiveness. The results of this research will be applied to the realization of the project, presenting here some specific points that have required a more in-depth study or that provide added value to this research work.

2. DEVELOPMENT

When designing a network it should be considered that there is currently no model from which a complete reference can be taken. All network projects are different, they are focused on specific objectives and each professional in the area faces these according to their experience and knowledge. However, there are certain elements and steps in common in all network design, which allows this to be done taking these.

The main benefits that are sought in a data network, to name a few, are:

- Expand into new markets.
- Reduce costs.
- Increase productivity.
- Offer new services.
- Have better support.
- Avoid service interruption due to network security problems.
- Avoid service interruption caused by natural disasters.
- Modernization of technologies.
- Reduce overloads associated with voice, data and video networks.
- Build relationships and accessibility of information throughout the company or institution.

These points help to understand how important it is to carry out a good network design, since this will allow its growth and the improvement of its services.

Methodology for designing networks with ITIL V3

Based on the analysis done previously, each of the company's requirements must be taken and ordered according to their priority, from the greatest need to the least important, and for each of these, answer each of these questions:

- Do company policies allow a solution to the need?
- Are there permissions from the company to implement the solution?
- Can the implementation of the new solution be done with the devices of the current network?
- Can the current network topology help to solve the problems?
- Can the current infrastructure be used to solve the need?
- Is the purchase of new devices required?

- Should new access points be created?
- Should new security and access policies be defined?
- Is it necessary to implement new servers?

Once these questions have been solved, a proposal must be designed to solve the needs. However, it is necessary for the designer to base his knowledge on previous network implementation experiences and to have as a reference the points defined in this methodology, since the design of the solution is a turning point, the proposal can be based on the following technological aspects of the network:

Logical and physical diagram

The first step in any network implementation is to make the physical and logical diagrams. These should give a specific vision of what will be required to satisfy the needs that were identified in the requirements analysis phase, the logical design includes planning the purpose of each element of the system, for this it is not completely necessary to consider the hardware or software.

A logical design must indicate:

- What are the outputs and expected results.
- What is the way to measure whether the processes give the expected results.
- How the results of one process affect other processes.

The logical design specifications are determined in:

- Output design. It is a description of all the outputs of the network and includes their types, format, content and frequency.
- Input design: Like the output design, the input design must specify the network inputs and include their types, format, content and frequency.
- Processing design. Types of calculations, comparisons and manipulations of data in general that the network system requires.
- Design of files and databases. For example, the ability to get instant updating of customer records is a logical design specification. In many cases, a database administrator is involved in this aspect of the design.
- Telecommunications design. During logical design it is necessary to specify the network and telecommunications systems. For example, in a hotel a client / server system could be specified with a number of workstations linked to the server.

The following considerations should be taken into account when designing:

- Location of distribution centers.
- Type and amount of cabling used to connect distribution centers and medium distribution facilities.
- Documentation of all cable runs.

Other more specific elements that a logic diagram of the network should contain can be:

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- Device identifiers.
- IP address and prefix lengths.
- Interface identifiers.
- Connection type.
- DLCI for virtual circuits.
- Site-to-site VPN.
- Routing protocols.
- Static routes.
- Data link protocols.
- WAN technologies used.

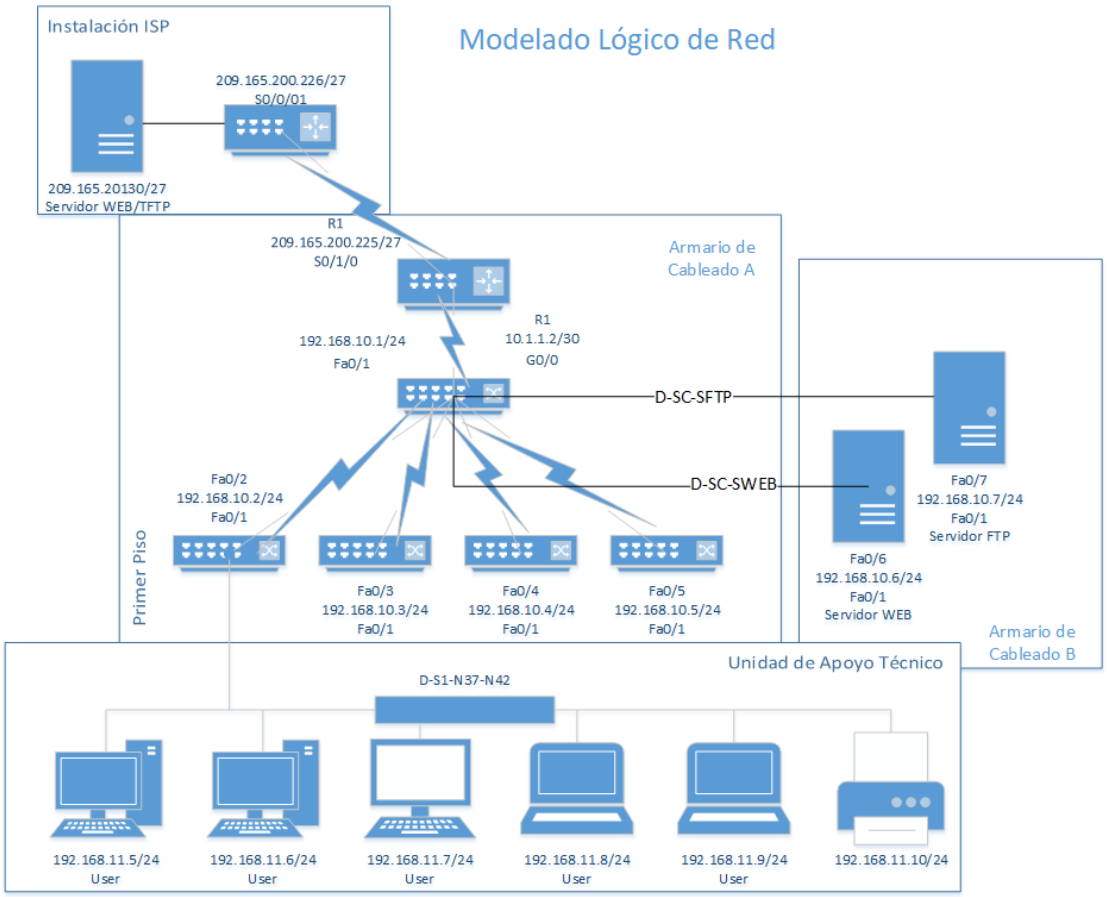

Figure 2. Example of a network logic diagram.

A physical network topology shows the physical layout of the devices connected to the network. To troubleshoot the physical layer, you need to understand how the devices are physically connected. The information recorded in the diagram generally includes:

- Type of device.
- Model and manufacturer.
- Version of the operating system.
- Cable type and identifier.
- Cable specification.

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- Type of connector.
- Cable ends.

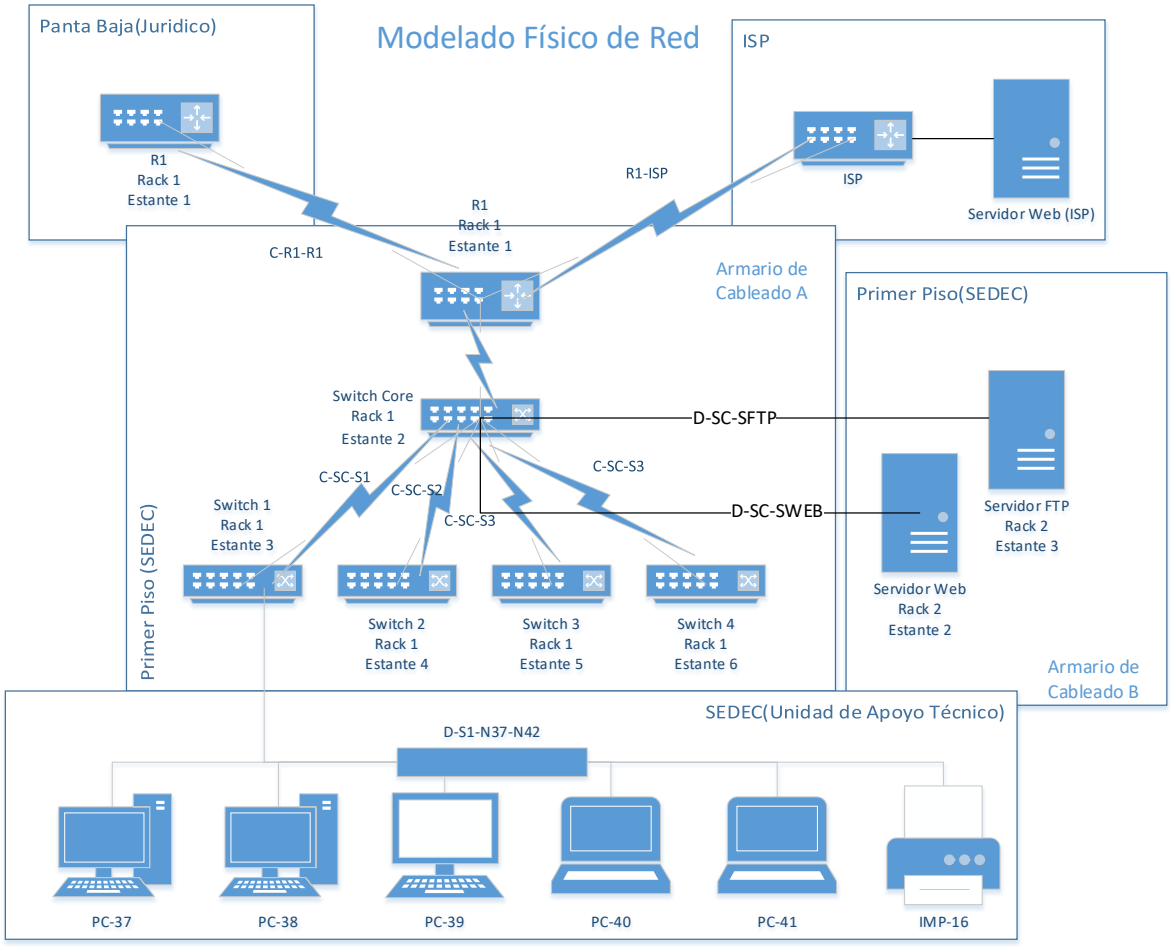

Figure 3. Example of physical network diagram.

Capacity management

Capacity Management provides information on existing and future resources, which allows the organization to decide which components must be renewed and when and how it must be done, so it must be taken into account in the organization's plans included in the Service Strategy (Bon, Jan Van).

If it is necessary to acquire new devices to complement the design, the following points must be considered:

- Hardware and software licensing costs.
- Annual maintenance costs.
- Personal of support or maintenance of the service.
- Price of the installation.
- Taxes, amortizations and interests.
- Compliance costs.

In this way, the resources required for implementation and the related costs can be clearly appreciated. Likewise, when acquiring new equipment, the needs that they manage to cover and the profit that their implementation represents for the company must be taken into account.

Device selection

In the analysis of network requirements, the devices of the network that are in the company are specified, this allows to evaluate if the network topology defined for the solution meets the requirements.

This is carried out by identifying the network topology to implement against what exists in the company, in case the acquisition of new equipment is required, it is necessary to make a comparative table of the different components of the required network, you must specify their pros and cons, as well as the capacity, cost, durability, guarantee and in what way the investment in the equipment would be returned.

Select topology

Necessary topologies must be defined for the implementation, but for this methodology it will be proposed to always use the star and extended star topology, which is based on the CSMA / CD protocol, one of the most used and most complete for network design.

Wiring selection

It is considered that for vertical lines, optical fiber should be used, with a higher price, but more reliable, presenting minimal interference problems in the middle, but for horizontal lines it is suggested to use Category 6 UTP cable, cheap and reliable for connection of network devices. But in the analysis of the requirements a broader picture is presented and allows to select more appropriately the types of cables required.

In order to properly select the cabling for the network design, it is important to consider the following points:

- Traffic load on the network.
- Level of security required in the network.
- Distances that the wiring must cover.
- Available wiring options.
- Budget for wiring.
- Electromagnetic interference.
- Electrical noise.

The last two points can be avoided by moving as far as possible close to cables or electrical installations. It is not recommended to use the same electrical wiring duct to install network cable. If it is not possible to run the wiring in this way, it is recommended to use shielded STP cable.

International standards such as EIA / TIA 568 should always be given low priority, which specifies that each device connected to a network must have a connection to the central horizontal cabling.

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Collision Domains

At this point, the number of hosts that are going to be connected must be determined, for all of these the connection of a switch should be used, ideally, each of the host devices are connected to a switch, the other technological consideration to Take into account is the number of switch to be connected, to carry out this step properly in the requirements analysis, a network traffic study had to be carried out, with it you can determine the capacity required to meet the needs of the network.

It must be borne in mind that today an estimate of the host to be connected is taken, then multiplied by 2 and thus the need to connect more devices is satisfied, but in this methodology a better way to determine this is proposed:

First, a projection of connected hosts must be generated from the creation of the company until today for each of the areas, in case of not having this information, it can be measured in the number of employees who have entered the company minus the number of employees who have left it, taking into account that each one of these represents a host on the network, then each of the hosts created must be limited per year.

Second, Add all the hosts and take an average of new connections, if possible a graph can be generated with the number of new connections per year taking the first year as a reference.

It should be considered that for each of the areas the number of hosts is very different, but each of the years for each area can be equalized by growth percentages.

Third, once this percentage is determined, the number of physical connections that need to be connected is taken well and multiplied by the percentage identified per averaged year (The area containing the similar number of connections is taken). For this definition of teams, accurate comparisons must be made between areas, for example, a software development company, the number of teams that connect from the human resources area to the software factory area in a development company is not the same that is why it is suggested that the number of connections be the same, this data is crucial for the implementation of host number.

Router Configuration

Consider the implementation of Vlans for the segmentation of the network, as well as delimit the network traffic and generate much smaller collision domains. Vlan creation allows for much tighter security control because you are limiting computer connections to a specific number of available connection points. For each one of the existing areas in the company, it is suggested to create a VLAN, after this the network administrator will be in charge of defining the accesses to each one of these together with the user administrator. The scalability in the routes is an important factor to take into account since these can serve as firewalls, it is important to use these to segment the network into sub-networks, to determine where the routers are going to be placed consider the following, the implementation of this solves problems of excessive broadcasts, resolves security issues and protocol incompatibility. It is in this configuration that the previous analysis carried out with the quality of service should be considered and said configuration applied in the network routers.

IP addressing documentation

All the IP addresses assigned to each of the network devices must be documented. An example of the elements that the IP assignment of a network must carry is the one that can be seen in the following table:

Subnet address	Subnet surface	Subnet name	Location	Connected devices
160.176.10.0	255.255.255.224	1.1	Backbone	3 Routers, 8 Servers
160.176.10.32	255.255.255.224	1.3	Technical Support Unit	10 PC, 1 Access point
160.176.10.64	255.255.255.192	1.4	Materials	7 PC, 2 Access point
160.176.10.128	255.255.255.192	1.5	Human resources	8 PC, 1 Access point
160.176.10.192	255.255.255.192	1.6	Data center	1 Router, 6 switch, 4 servers

Table 1. Example of IP addressing documentation.

Generate proposal

This point contains an overview of the IT services in use, oriented to the client of what their usefulness may be, business processes that they facilitate and the level of quality that the client can expect in each service, so these following aspects should be considered:

1. Needs identified and classified. The priorities of each one and their SMART (Specific, Measurable, Acceptable, Realistic and Time-limited) must be specified.
2. Available resources. Specify the network devices that the organization has for the start-up, supported by the logical design and the existing operational capacity for the implementation of the improvement.
3. Drawbacks. It is necessary to delve into the problems and inconveniences raised by the client in addition to the future ones that are likely to arise in the network. For this, one can rely on the information traffic identified in the analysis stage.
4. Logical diagramming. The result of the analysis and design must be shown to the client.
5. Demand management. Specify the network devices, cabling, staff training, equipment distribution that will be involved in the implementation. Make a list of the devices that the company currently has and if they can be used for the new implementation, as well as a list of devices that are required. As it is a proposal, it is necessary to present different devices, configuration and price, include network cables, gutters, UPS, necessary network points, electrical points with their respective costs and benefits.
6. For each of the needs, it is necessary to specify the benefits that the implementation brings. This should be done taking as a reference the needs identified throughout the analysis stage and base the results with the design of the network.
7. Conclusions. Specify the conclusions.
8. Suggestions. Suggest teams for implementation or any details that contribute to this process.

3. CONCLUSIONS

To carry out a good network design, an analysis of the needs and requirements of the company must be carried out, classifying and prioritizing them.

A methodology based on ITIL allows a different approach to design, insists on the inclusion of the entire company or institution in carrying it out, seeking to adequately satisfy the greatest number of needs.

The necessary guidelines for the network design should be established considering influential factors of the technology, leading to the objectives of the company and the projection for future growth.

Also, by including the good ITIL practices in the design of existing networks, it allows to ensure the quality of the process, in addition, it reduces costs without depreciating the value of the result.

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