

Location, Location, Location: About Home Networking Devices Location and Features

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Abstract. A home. It is where people spend most of their family time. It is a place to gather friends. It is somewhere to escape the world in the comfort of someplace that is our own. And it is a location that is filled with a variety of big and small appliances and devices. The number of appliances, their size, shape, and their features change over and over again, and based on the advancement in technology, there are changes in the needs of consumers alongside a certain expectation of comfort and productivity. One of the properties of a device in a home is the location in which people place it. Where to place the device depends, among other things, on its use and the features that the device offers as well as its aesthetics. This study investigates the location of home networking devices, also known as routers, in modern houses. It also looks at how router features accommodate users based on the location where people keep the devices and how their needs have evolved.

For this study, 95 participants were surveyed about the location of their home networking devices (routers) location then, 43 locations were evaluated from houses located in Silicon Valley, California. The results provide the data on the rooms where people keep their routers, their physical location, and certain idiosyncrasies of their usage. In light of this study we have extracted some results and hypothesized some guidelines for future designs of routers in the consumer market.

Keywords: Home Networking, Network Device Location, Device Location versus Features, Router Location.

1 Introduction

Whether or not you live in a small apartment or a luxurious house, the device and appliances that you choose for your home, their size, features, location, aesthetics, and cost are all important factors in your decision. A rapid review of some home appliances over time illustrates how much they have evolved as technology has advanced and expectations of comfort have risen. Take, for example, a telephone device at home. Early phones were a luxury item that gradually turned into a home necessity in western countries. Soon the telephone became an important device often found in the kitchen, living room or family room.

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Telephone usage has changed drastically from that lonesome, lavish device in a single room. And yet despite this, a telephone's main feature, allowing two parties to communicate by voice, has not changed but instead been expanded on. So many features have been added to it, while at the same time its location at home, size and aesthetics have evolved a lot. The most traditional location for a phone in a US household is in the kitchen, mounted on a wall. [1]

Another item that technology has radically affected in households is the clock. Clocks range from large grandfather clocks in the living room to smaller and fancier ones. Eventually the time display traditionally associated with clocks became incorporated into most devices. Just think about how many time-displays you might have in your house. I could count up to six, and that was excluding cell-phones and computers.

With the speedy expansion of the Internet and Internet-based technologies in homes, an Internet connection has become a basic utility like electricity, gas, or water. Consequently, a wireless home is becoming almost a standard item in a house independent to the size of each individual home [2]. From a dial up modem in the computer to a smart appliance that needs to communicate with networking devices, home networking devices are continuously changing [3]. This study tries to understand how these devices are used from the location they are placed in, aesthetics, size, and positioning. The study should provide us with some input as to how to improve these devices based on their actual usage. To the best of our knowledge, no other study has been yet been conducted from this perspective [4].

2 Method

In this investigation to learn where and how people use their home networking devices (i.e. routers), two studies were conducted in parallel:

Group 1 (Online Questionnaire): 95 participants completed the online survey (self-reported).

Group 2 (Location Investigated): Information about 43 houses and the location of the networking devices was collected in a paper survey including pictures of the device location.

To better understand the pattern of usage, a follow-up study on seven locations selected among the second group is in progress. These seven houses are all located in Silicon Valley, California in the United States. The process of visiting each location and evaluating the location and configuration of the networking device was investigated along with a semi-structured interview with one of the homeowners—the person who most often managed the home networking devices.

3 Results

3.1 Survey 1 Results

In the first survey, 95 participants reported the size of their home, the room where the device was located, and the device brand. 38% of the homes are 1-2 bedroom

apartments/houses, 17% are 3 bedroom houses or town houses, 40% are 4 bedroom houses, and 5% are other type of facilities.

The networking device (router) is said to be placed in the living room in 45% of the cases, while 28% stayed in the bedroom, 13% in the office, 3% the garage, 2% a spare room, and 8% in other locations. Almost all of the brands are represented in the participant sample group: Berkin 4%, Dlinks 11%, Linksys 20%, AT&T 22 %, NETGEAR 24%, and other brands 19% (Fig 1).

This result shows that overall users are most likely to keep their networking device in their living room or bedroom. There does not seem to be a much of a correlation between this preference and the size of the apartment/house (Fig 2, 3 and 4). However, in bigger four bedroom homes with Silicon Valley standards, the likelihood of an office being the area of placement for the router increases. While manufacturers often claim a wide area of coverage for wireless connections, it seems that this is not always the case as certain obstructions are not taken into account. This is one reason that users keep their devices close to entertainment devices such as televisions, sound systems, or laptops depending on usage. The proximity to the entertainment unit would thus allow for a wired connection as well.

In addition, since wireless devices do not cope well in transmitting with the presence of physical obstructions such as cabinets or drawers, mirrors, glasses, metallic objects, thick walls and ceilings, users are limited when it comes to the choice of room for their router. To get the better signal, the user is almost stuck choosing their living room or bedroom.

The other issue that users are confronted with is interference with neighboring wireless networks, microwave ovens, 2.4 GHz cordless telephones, Bluetooth devices, wireless baby monitors or other similar devices. Since solving the interference often requires the difficulty of management or a change of channel and the SSID on users' router, most users instead turn to changing the physical closeness of their router rather than managing their home networking for a better efficiency.

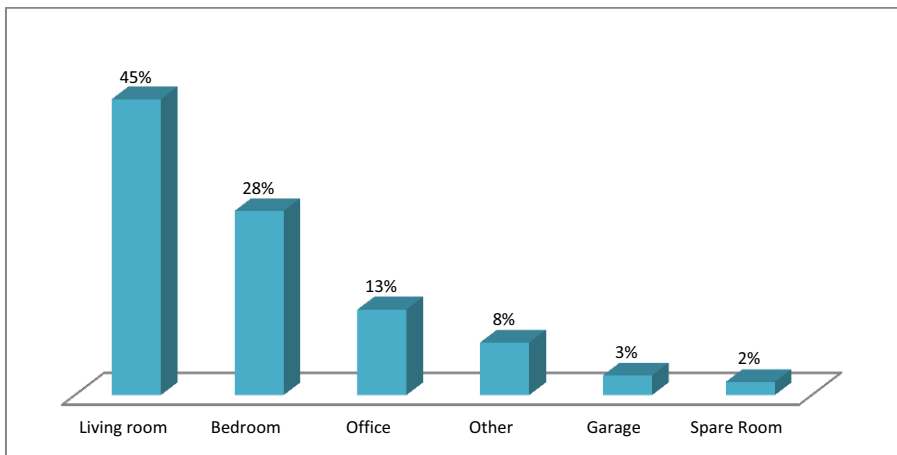


Fig. 1. Room where networking device (router) is located. (95 Locations in Silicon Valley, California, USA)

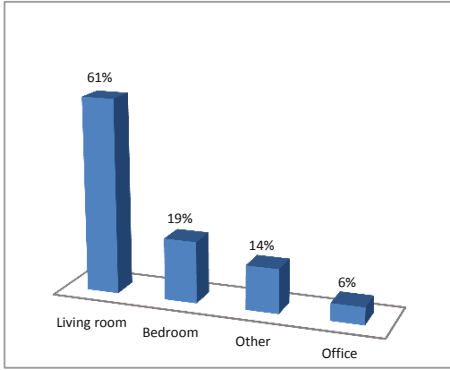


Fig. 2. Room where networking device (router) is located in 1-2 bedroom apt. or houses

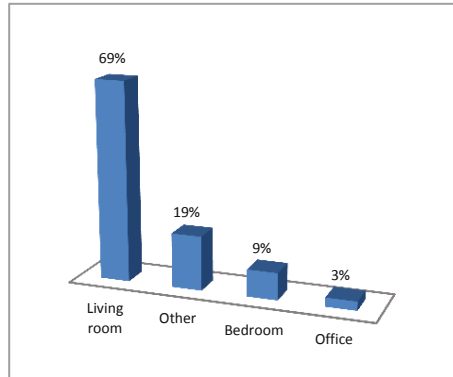


Fig. 3. Room where networking device (router) is located in 3 bedrooms houses

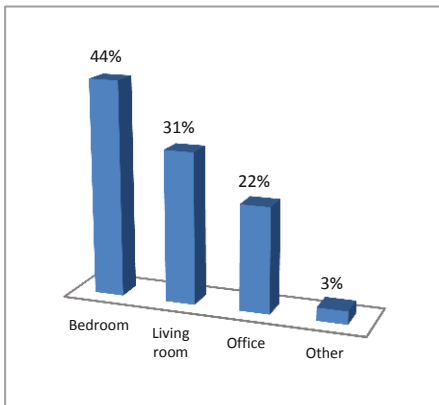


Fig. 4. Room where networking device (router) is located in 4 bedroom houses

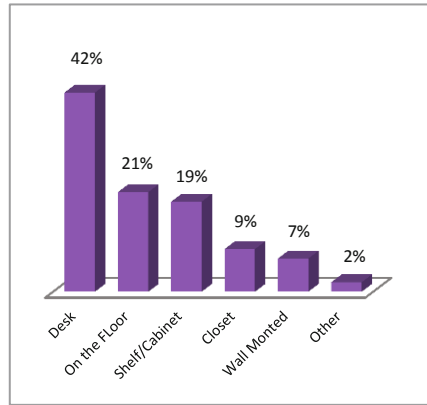


Fig. 5. Area where networking device (router) is located in a 1-3 bedroom home (43 Locations)

3.2 Survey 2- Location Investigation Results

The result of the second survey includes the data from the room where the device is placed and pictures of the exact physical location of the device.

The physical location of the devices indicates that 42% are placed on a desk, 21% on the floor, 19% on a shelves or cabinet, 9% in a closet and 7% mounted on walls. In this same study, 23% of devices are placed in a bedroom, 49% in a living room, and 5% in each of the following locations: garage, spare room or other location. This

survey thus provides support on the previous one in terms as to the commonality of where the device is located (Fig. 2 & 5).

The physical location of the device in each room seems to be in accordance with the room placement. On a shelf or desk close to a computer seems to be a natural choice, but still 21% of people keep their router on the floor. A closer look at the provided pictures indicated that in most of the cases the wireless device was also very close to a cable plug and Internet cable in the electrical cabinet. While some devices offer the wall mounting feature for the device, only 7% were placed so.

The data taken from the pictures provided were classified and revealed that:

- Routers were mostly placed next to an appliance like a telephone or computer (Figure 6).
- Multiple wires around the router create a very unpleasant and cluttered situation (Figure 7).
- Positioning of the device is horizontal or vertical according to the design of the device (Figures 8 and 9).
- Most of the devices were placed in the open and were not hidden (Figure 9).

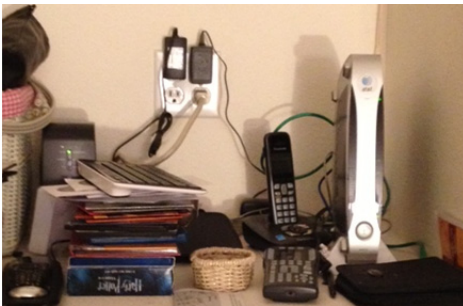


Fig. 6. Router on desk close to telephone



Fig. 7. Multiple wires around the router



Fig. 8. Router in open air with vertical positioning



Fig. 9. Router on desk with horizontal positioning

4 Data Analysis and Design Concepts

The results from this empirical study tend to suggest a pattern of behavior in most networking device usage at home, including the following:

- Most people place their router in the living room
- Routers are almost always placed close to other electronic devices such as a computer
- The mixture of wires from other devices creates a very common chaotic situation around the router
- Most users seem to be unaware of certain positions of the router that would offer optimal performances in accordance to range
- Only a very small number of the users observed mounted the router on the wall or placed the router in a discrete location such as in a closet or the garage
- Although most of the routers observed offered multiple USB ports for connecting an external storage drive, no one observed in this sample was shown to use them
- Although most of the router models evaluated in this study offered up to four wired connections and one to two USB ports, in addition to an ADC adapter wire and a main network connection, it has been observed that it is rare for any of these additions to be used
- When the offered ports are used, it seems that the multiplicity of the wired device makes the routers, which are designed for vertical positioning, somehow unstable

The results from my observed study tend to suggest a common pattern of behavior in most networking device usage at home. In addition, it helps us to extrapolate a number of issues that seem to not yet have been considered in current designs.

In light of this study, in this section we are going to look at some current identified issues, define some possible technological or environmental changes for home networking, and then try to hypothesize some guidelines for future designs of routers in the consumer market.

Some observations of current router design:

- Current router design does not offer wireless coverage in a large enough diameter to offer strong signals throughout a house independent of where the user chooses to place the router in the house.
- The router offers some features that only a small percentage of users utilize, but ultimately the cost of these features is paid by all users. This includes the number of USB ports or card reading ports, and to some degree the number of Ethernet ports.
- Routers seem to have been designed with the wrong assumption about the positioning of the devices. For example, it is assumed that people might use the wall mounting fixture but in reality a very small percentile choose to employ that facet. Again this assumption creates an ignored feature that a majority of customers still have to bear the cost of.
- Average users often have difficulty understanding the documentation, labeling, and information on the package. These provide an explanation of the features but not

what it is they do. For example, text on a router package indicates “Dual Band avoid interference,” or “DLNA Media Server,” but it does not indicate what DLNA does for the user. More scenario-based information or help could read: “Suitable for a 2-bedroom home with cable; share media (video, pictures, and music from a central location)”. Without this, it becomes common for customers to purchase products that do not fit their true needs.

- Most networking devices seem to have been designed in imitation of a competitor’s product rather than based on what users really need. A good example of this is the USB ports on routers, which are rarely used but continuously offered.
- Whenever users need to use multiple ports such as connecting the USB ports or adding Ethernet cables, the small device becomes very hard to position and creates a messy environment that is not necessary or pleasant to have in a living room, and in some cases may even be dangerous.
- Users have a hard time understanding that they can change the device’s configuration by logging into the user interface of the device to make further changes. Even when they are shown how to do so, they are discouraged by its complexity as well as worried about changing something incorrectly and having it affect their network.
- The device designs do not seem to take into consideration the reality of new homes and systems. The router offers the USB port while most of the devices now connect wirelessly to the network.

Now let’s take a look at some possible technological or environmental changes in home networking and hypothesize some guidelines for future designs of routers in the consumer market.

- There are going to be more and more smart devices that require wireless access for full operation, such as refrigerators, heating systems with temperature controls, surveillances systems, washing machines, and so on. These devices are going to be positioned all around in the household and will thus require the home networking device to provide sufficient signal to reach all appliances around the house.
- The device should offer an incorporated capability (internal drive) to back up the system configuration of all connected devices.
- The user should be able to communicate with the device directly though a touch screen, rather than through a computer interface.
- The device should have a test feature to detect and problem solve any issues, periodically scan the network, and show the status of the system.
- The device should include a security features that works well and is easy to manage.
- The device should be built in a way that can be incorporated as a display into a specific location.
- Interaction with the device should be extremely easy for average homeowners/users. The users will not be able to handle the complexity of a featured home networking system if it is not easy to understand and operate.
- Device should be very robust and offer one-click functionality to users in case of any issues so that the device will diagnose and problem-solve the issues.

5 Conclusion

Although this study offers some indication about how the networking devices are used, the number of houses, their type, size and locations are among other factors that need to be taken in consideration in future studies. On top of that, the houses studied in this sample are located in one of the most developed areas on the planet: Silicon Valley, California in the United States, and so do not reflect other geographical locations or residences, especially those in a more urban city setting. Further studies are needed to evaluate the usage of routers in different types of homes and apartments located in big and rural cities.

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