

IMPORTANCE OF VIRTUALIZATION INSIDE SELF-DRIVING CARS

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Abstract: Nowadays, the demand for self-driving technologies has increased, so developers must create ways to perform design tests with incredible speed and reliability in their results. The virtualization of real automotive test scenarios has helped to understand and correct various deficiencies self-driving cars have and how reliable they can be. In this document, the programs, companies, and results of the development of autonomous vehicles designed and tested under virtual scenarios, benefits, and deficiencies that have been presented were collected.

Keywords: Automotive, Reliability, Self-Driving Cars, Simulation, Software, Virtualization.

1. INTRODUCTION

The extensive development of new technologies focused on automated systems has generated a demand for digital resources, such as processing speed and storage capacity. To solve this, algorithms have been developed for artificial intelligence, the ability to adapt to random events and the cloud for storage[1]. This has been a significant advance, but at the same time, it has generated considerable uncertainty among users, "It is safe to let a machine decide." For the development of these technologies, several extensive tests are necessary, and unforeseen factors are taken into account[2]. You couldn't give a concrete answer to how reliable the systems will be in everyday life without actual testing, which has been done for decades. This has left a lesson, although the methods are safe (under controlled conditions), an external event could end in an accident[3]. The tests in natural environments have generated several advances but, in the same way, significant criticisms due to accidents[4].

In the last decade, more sophisticated digital testing methods have been developed, making countless tests digitally (separate systems in controlled environments or predicted variables); this has helped to have more secure systems[5]. The development of digital environments capable of replicating daily situations requires a significant investment of monetary resources and time, which is why it was not given the necessary importance until a few years ago to bring autonomous vehicle technology to the forefront[6]. Level 4 means that it can move autonomously without the need for the intervention of a human being[7]. Digital environments capable of replicating real situations have been created, including events that cannot be controlled. The virtualization of driving systems and digital scenarios (very close to natural) has been the push this technology needed to develop, test, and correct autonomous vehicles [8].

The great benefit of using digital environments is that they are easy to recognize, physical losses of both cars and pilots are not generated, and several simulations never thought of in real life can be carried out (thousands of times more). System reliability and correction capacity are timely[9].

2. VIRTUALIZATION

Virtualization refers to creating a digital version of a natural system, which can be translated as using software to simulate the functionality of the hardware[10].

Although the term was used decades ago, its implementation in a more objective way has been slowed down by the necessary resources, its first steps in large industries have been in the IT field, being able to control network control systems worldwide remotely, monitoring adverse situations or a malfunction can be recognized and corrected, avoiding the loss of hardware[11,12,13,14,15].

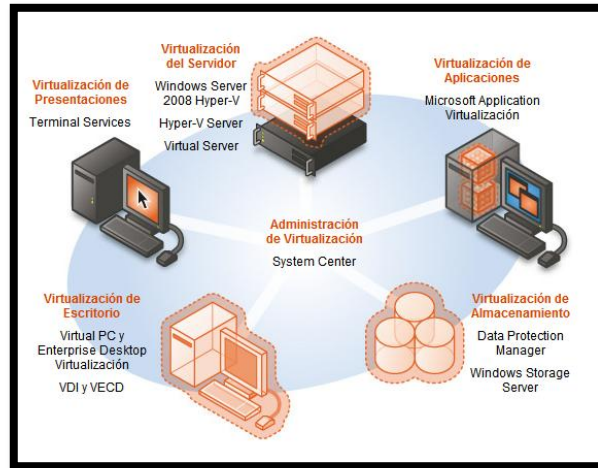


Figure 1: IT virtualization center example

Increases efficiency, reliability, and availability by delivering business continuity and disaster recovery solutions right to the desktop by eliminating service interruptions, whether planned or unplanned[15]. Virtual desktops and apps create a more flexible business infrastructure that enables you to respond quickly to changing business needs. You'll be able to deploy apps and desktops faster and with fewer help desk calls to improve business continuity. Costs will drop, and service levels will increase [16].

3. METHODOLOGY

In virtualization, you have a hypervisor, a virtual machine monitor or VMM, software that creates and runs virtual machines (VMs). A hypervisor allows a host computer to support multiple guest virtual machines by virtually sharing their resources, such as memory and processing. It can run multiple operating systems on top of one server (bare-metal hypervisor) or be installed on top of one standard operating procedure and isolated from it (hosted hypervisor)[17].

- The virtualization process follows the steps listed below:
- Hypervisors detach the physical resources from their physical environments.
- Resources are taken and divided, as needed, from the physical environment to the various virtual environments.
- System users work with and perform computations within the virtual environment.
- Once the virtual environment is running, a user or program can send an instruction that requires extra resources from the physical environment. In response, the hypervisor relays the message to the physical system and stores the changes. This process will happen at an almost native speed[18].

ADVANTAGES OF VIRTUALIZATION:

Lower costs. The reduction of physical servers reduces the cost of purchase and maintenance. Easier disaster recovery. Real-time monitoring makes it easy to detect and correct errors and back up and recover virtual machines[19]. Easier tests. Allows instant correction without the need to reboot the system. Faster backups. Backup copies are generated in a virtual machine that can be migrated to moments in the past without loss of information[20]. Improved productivity. The use of fewer physical devices reduces maintenance time and dedicated personnel[21].

4. BENEFITS OF VIRTUALIZATION

Determined servers. The ease of separating system services provides more order and reasonable distribution of resources.

Accelerated deployment and redeployment. The backup is carried out constantly so that information is not lost and cloning is easy and fast[22].

Less heat and better energy savings. The problem of heat generation by large processing centers is corrected with the use of less equipment[23].

Easier migration to the cloud.

Lack of supplier dependency. Implementing systems in free-use virtual environments means not having a provider to use virtual resources[24].

5. ENTERPRISES

VOYSYS: Enterprise is dedicated to video communication solutions over unreliable 4G/LTE networks for monitoring and remote control autonomous vehicles, machines, and robots.

Anyverse: (formerly Next Limit) draw upon 25 years of experience, always at the forefront of innovative simulation solutions. Anyverse headquarters are in sunny Madrid (Spain) with a team spread across the globe.

NVIDIA: Tapping into decades-long experience in high-performance computing, imaging, and AI, NVIDIA has built a software-defined, end-to-end platform for the transportation industry that enables continuous improvement and deployment through over-the-air updates. It delivers everything needed to develop autonomous vehicles at scale.

6. CONCLUSIONS

The initial investment in system virtualization is significant. However, server maintenance costs are reduced. Providers dedicated to this environment conduct adequate studies for each type of company.

Training personnel in virtual environments is necessary for appropriately using this technology, in addition to the possibility of a lack of adaptation to various services in virtual environments.

Security risks in virtual environments become essential; crucial data should be taken care of and separated from the system.

Finally, in a virtual environment, users lose control of what they can do because multiple links must collaborate to accomplish the same task. If any part doesn't work, the whole operation will fail.

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