

HISTORY OF REAL TIME COMPUTING

Group 5

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1. INTRODUCTION

In a modern world of complex operation modes like asynchronous and functional programming, It is important to appreciate the simple methodology of real-time programming. It's a concept that emerged alongside what we consider modern computing and is still present in some form in nearly every computing application today. Everything from anti-lock brake controls, to space flight, to nuclear powerplant control units; everything uses real-time programming. The idea is simple: every input produces a near-instant output, and tasks are scheduled and run at exact times. Any delay, even a few milliseconds can be considered as a failure, and thus while it is a simple concept on paper, it is far more difficult to achieve in practice. This struggle and development is ongoing and continues to produce new solutions, both hardware and software, every year.

2. TIME PERIOD

Real time computing was developed alongside standard use cases for computers when real time simulations were implemented. In some early systems starting in the 1970's real time operating systems could be used on personal desktop computers. However, real time computing systems primary use case is in highly precise and time critical real world systems such with cars and automated military systems and simulations. Therefore, they subsequently gained the attention of industry and government usage across a massive array of applications. Although they are an incredibly specific use case, where in general timing accuracy and task management, real time computing systems are still in use today in many modern digital systems.

3. COMPUTER HARDWARE

The hardware in real-time computing must be extremely dependable and precise. This is critical because any delay may cause the entire system to fail. Real-time Computing is used in many real life situations, from car breaks to launching missiles. A couple examples of the hardware in real-time computing is Xilinx FPGA and SoC boards, System-on-Modules, and Alveo Data Center accelerator cards. Another way to create more powerful hardware is by adding a real-time micro kernel between the normal hardware and the Linux kernel.

4. COMPUTER SOFTWARE

The main piece of software on a real-time computer is a real-time operating system (RTOS). An RTOS is an operating system that processes data as it comes into the system with little to no delay. The RTOS has a very limited amount of time (usually measured in tenths of a second) to process the data and if it can't process the data in time, the entire system will fail. While this seems useless, it actually is very important. Real time operating systems can be found in computer systems for cars and spacecraft for NASA, where performance is key. For example, the computer system controlling the self driving function in a Tesla needs to process data in near real-time in order to prevent a crash.

5. CONCLUSION

In conclusion, real time computing is an extremely niche and incredibly difficult to develop and implement type of computing. Real time computing is often broken into three different categories of acceptable time tolerances. However, even for the less constrained real time computing systems, the interplay between critical scheduling of programs and processes is incredibly precise, often requiring precision down to the microsecond.

The reason for this is largely the application regime for real time computing, which includes life and death consequences for even miniscule errors. Such critical systems include braking systems in cars and missile guidance systems. Although incredibly specific in its potential use cases, real time computing is an integral part of modern real world applications.

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