**WHAT IS REVERSE-ENGINEERING?**

Reverse-engineering is the act of dismantling an object to see how it works. It is done primarily to analyze and gain knowledge about the way something works but often is used to duplicate or enhance the object. Many things can be reverse-engineered, including software, physical machines, military technology and even biological functions related to how genes work.

The practice of reverse-engineering as applied to computer hardware and software is taken from older industries. Software reverse-engineering focuses on a program's machine code -- the string of 0s and 1s that are sent to the logic processor. Program language statements are used to turn the machine code back into the original source code.

Depending on the technology, the knowledge gained during reverse-engineering can be used to repurpose obsolete objects, do a security analysis, gain a competitive advantage or simply to teach someone about how something works. No matter how the knowledge is used or what it relates to, reverse-engineering is the process of gaining that knowledge from a finished object.

**What is the purpose of reverse-engineering?**

The purpose of reverse-engineering is to find out how an object or system works. There are a variety of reasons to do this. Reverse-engineering can be used to learn how something works and to recreate the object or to create a similar object with added enhancements.

Often the goal of reverse-engineering software or hardware is to find a way to create a similar product more inexpensively or because the original product is no longer available. Reverse-engineering in information technology is also used to address compatibility issues and make the hardware or software work with other hardware, software or operating systems that it wasn't originally compatible with.

Apple's Logic Pro software, which lets musicians compose, record, arrange, edit and mix music, is a good example. Logic Pro is only available for Mac devices, and it is relatively expensive. The program has several proprietary digital instruments. With a bit of investigation, a programmer could reverse-engineer those digital instruments, figure out how they work and customize them for use in Logic Pro or to make them interoperable with other music software that is compatible with Windows.

**How does the reverse-engineering process work?**

The reverse-engineering process is specific to the object on which its being performed. However, no matter the context, there are three general steps common to all reverse-engineering efforts. They include:

* Information extraction. The object being reverse-engineered is studied, information about its design is extracted and that information is examined to determine how the pieces fit together. In software reverse-engineering, this might require gathering source code and related design documents for study. It may also involve the use of tools, such as a disassembler to break apart the program into its constituent parts.
* Modeling. The collected information is abstracted into a conceptual model, with each piece of the model explaining its function in the overall structure. The purpose of this step is to take information specific to the original and abstract it into a general model that can be used to guide the design of new objects or systems. In software reverse-engineering this might take the form of a data flow diagram or a structure chart.
* Review. This involves reviewing the model and testing it in various scenarios to ensure it is a realistic abstraction of the original object or system. In software engineering this might take the form of software testing. Once it is tested, the model can be implemented to reengineer the original object.

**Computer-aided design (CAD)** is a reverse-engineering technique used to recreate a manufactured part when the original blueprint is no longer available. It involves producing 3D images of the part so it can be remanufactured. A coordinate measuring machine measures the part, and as it is measured, a 3D wire frame image is generated using CAD software and displayed on a monitor. After the measuring is complete, the wire frame image is dimensioned. Any part can be reverse-engineered using these methods.

**One example is Phoenix**, a U.S. software company that created basic input/output system (BIOS) software, which was compatible with IBM's proprietary version. To do this, Phoenix reverse-engineered the IBM version in a way that protected them from copyright charges, by recording the steps it followed and not referencing the proprietary code.