An Overview of Reverse Engineering

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Different Approaches

- Top-down and Bottom-up strategies of information processing, knowledge ordering.
- Top-down approach
- breaking down of a system to gain insight into its compositional sub-systems in a reverse engineering fashion.
- Each subsystem is then refined in yet greater detail
- Top down approach starts with the big picture. It breaks down from there into smaller segments.

- https://en.wikipedia.org/wiki/Top-down_and_bottom-up_design#Computer_science

Manufacture

- Manufacture is the process of changing nature in order to meet the necessity of people to develop and sustain their existence. This effort is also the process of changing man's nature while he is changing nature.

Engineering ?

- The creative application of scientific principles to design or develop structures, machines, apparatus, or manufacturing processes, or works utilizing them singly or in combination; or to construct or operate the same with full cognizance of their design; or to forecast their behavior under specific operating conditions; all as respects an intended function, economics of operation and safety to life and property.(Britannica)
- Application and practical knowledge
- Invent, innovate, build, improve, maintain etc
- https://en.wikipedia.org/wiki/Outline_of_academic_disciplines

Reverse Engineering

- *Extraction of **knowledge** methodology,structure or design etc.*
- **Reverse engineering, also called back engineering, is the process of analyzing a subject system to create representations of the system at a higher level of abstraction.**
- **“going backwards through the development cycle”**
- *https://en.wikipedia.org/wiki/Reverse_engineering*

Reverse Engineering

- Kısaca, Mühendislik olgu veya ürünün diyalektik bakış ile ortaya çıkışı ise olgu ürün veya sürece karşı diyalektik bir bakış açısı da tersine mühendisliktir.
- Reverse Engineering is the foundation of Engineering. NAPOLEON BONAPARTE (1453)

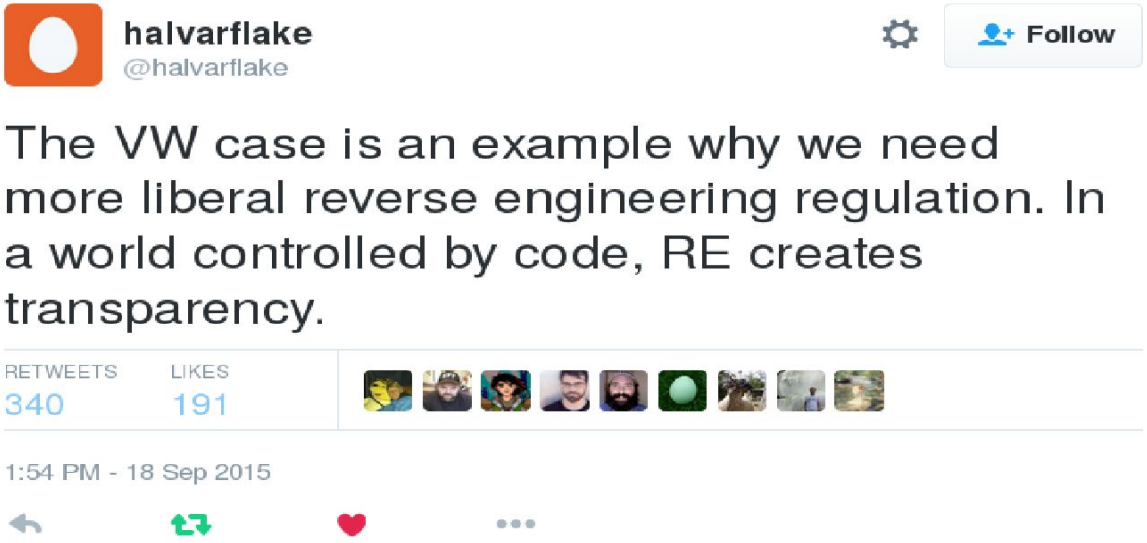
Motivation

- Espionage ?
- Outdated software/hardware that nobody knows ?
- Remove restrictions on software/hardware.
- Security
- Bug fixing
- Examine viruses and malware
- Open-Source ?

Example Projects

- **Wine**
- Samba
- **OpenOffice & LibreOffice**
- **ReactOS**
- Windows Internals

Tansparency ?



https://en.wikipedia.org/wiki/Volkswagen_emissions_scandal

Application Fiels of RE

- Bus analyzer
- Clone (computing)
- Connectix Virtual Game Station
- Cryptanalysis
- Forensic engineering
- Decompile
- Software cracking
- Software archaeology
- etc.

Application Fiels of RE

- Reverse engineering of software
- Reverse engineering of integrated circuits/smart cards
- Reverse engineering of protocols
- Reverse engineering of machines

Reverse engineering of software

- Institute of Electrical and Electronics Engineers (IEEE) defined reverse engineering as "the process of analyzing a subject system to identify the system's components and their interrelationships and to create representations of the system in another form or at a higher level of abstraction", where the "subject system" is the end product of software development.
-

How ?


#include<stdio.h>
int add(int prm1, int prm2)
{
int result;
result = prm1 + prm2;
return result;
}
int main()
{
int i = 10;
int j = 20;
int sonuc;
sonuc = add(i, j);
printf("Sonuc = %d", sonuc);
getchar();
}
DERLEME
LİNKLEME
push ebp
mov ebp,esp
sub esp,0C
mov dword ptr ss:[ebp-8],0A
mov dword ptr ss:[ebp-4],14
mov eax,dword ptr ss:[ebp-4]
push eax
mov ecx,dword ptr ss:[ebp-8]
push ecx
call PE-x86-0.add
add esp,8
mov dword ptr ss:[ebp-C],eax
mov edx,dword ptr ss:[ebp-C]
push edx
push PE-x86-0.00403000
call PE-x86-0.printf
add esp,8
TERSİNE MÜHENDİSLİK

Enviroment Variable

- Mimari: Intel x86, PowerPC, ARM vs.
- İşletim Sistemi: GNU+Linux, FreeBSD, Windows vs.
- Sanal Ortam: Java, .NET vs.
- Çalıştırılabilir Dosya: PE, ELF vs.

Reverse engineering of integrated circuits/smart cards

- Reverse engineering is an invasive and destructive form of analyzing a smart card. The attacker grinds away layer after layer of the smart card and takes pictures with an electron microscope. With this technique, it is possible to reveal the complete hardware and software part of the smart card. The major problem for the attacker is to bring everything into the right order to find out how everything works. The makers of the card try to hide keys and operations by mixing up memory positions, for example, bus scrambling.
- https://twitter.com/i/status/1112642788439588864

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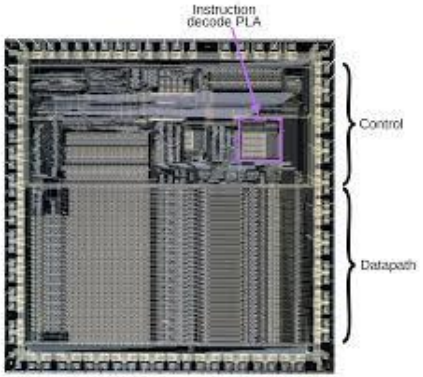
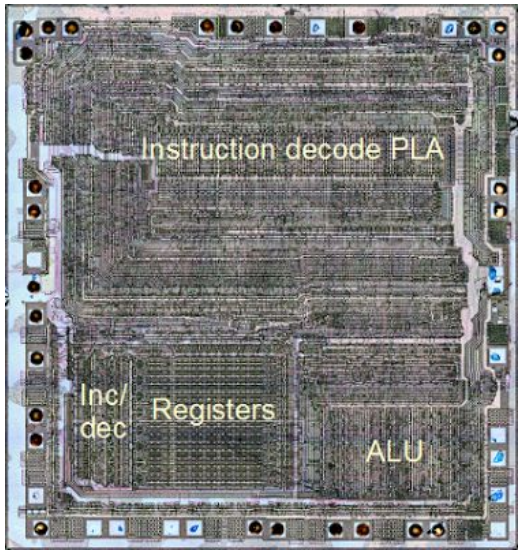
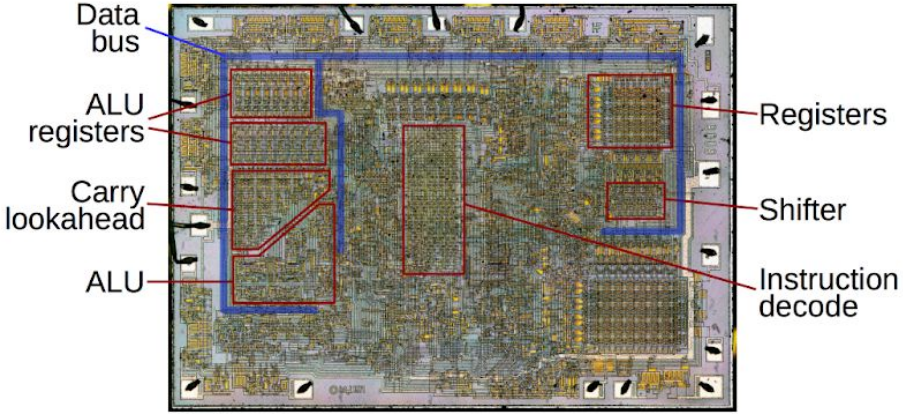
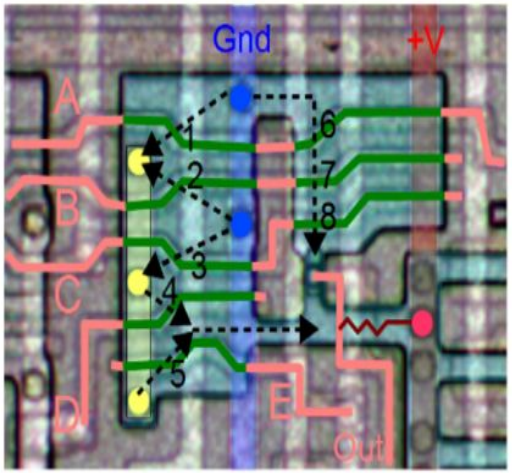
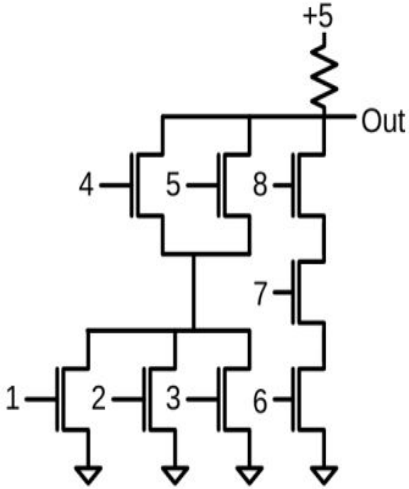


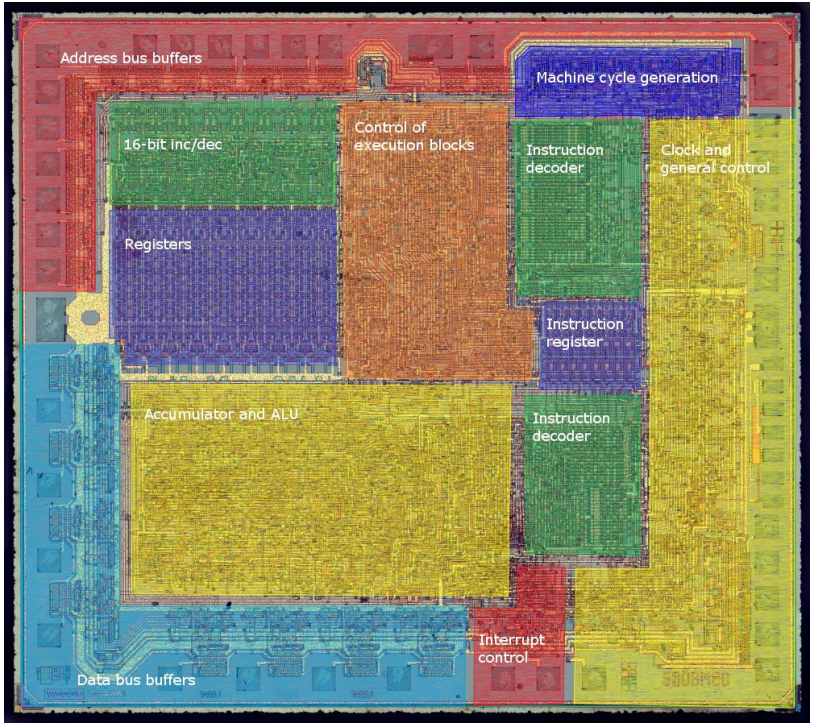

Instruction decode PLA
Inc/
dec
Registers
ALU


Data
bus
ALU
registers
Carry
lookahead
ALU
Registers
Shifter
Instruction
decode

Gates get weird in the ALU

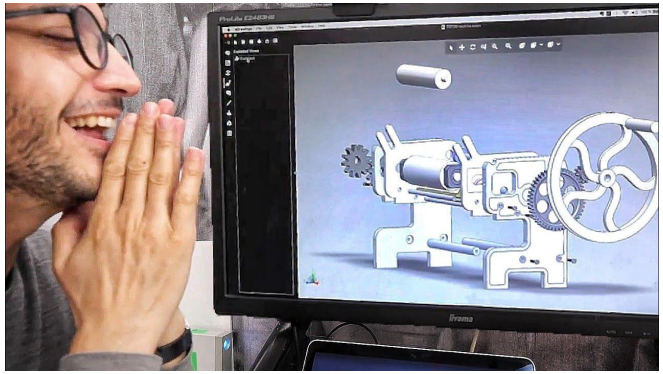






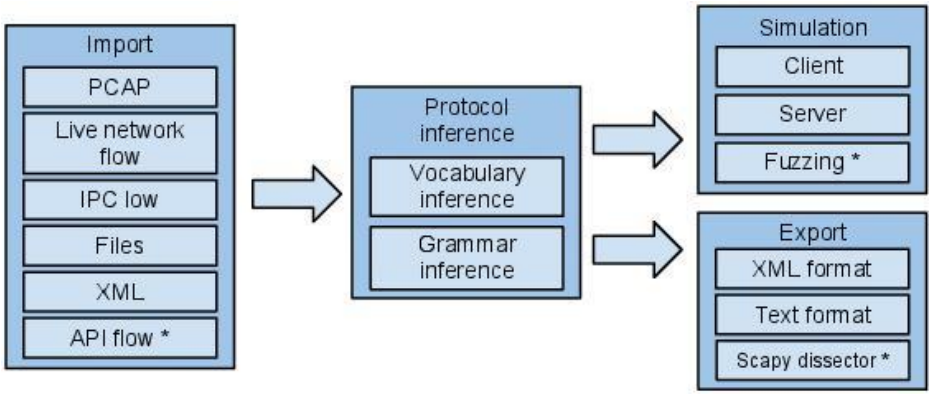
Reverse engineering of machines

- As computer-aided design (CAD) has become more popular, reverse engineering has become a viable method to create a 3D virtual model of an existing physical part for use in 3D CAD, CAM, CAE or other software.[10] The reverse-engineering process involves measuring an object and then reconstructing it as a 3D model. The physical object can be measured using 3D scanning technologies like CMMs, laser scanners, structured light digitizers, or Industrial CT Scanning (computed tomography).



Reverse engineering of protocols

- **Protocols are sets of rules that describe message formats and how messages are exchanged (i.e., the protocol state-machine). Accordingly, the problem of protocol reverse-engineering can be partitioned into two subproblems; message format and state-machine reverse-engineering.**

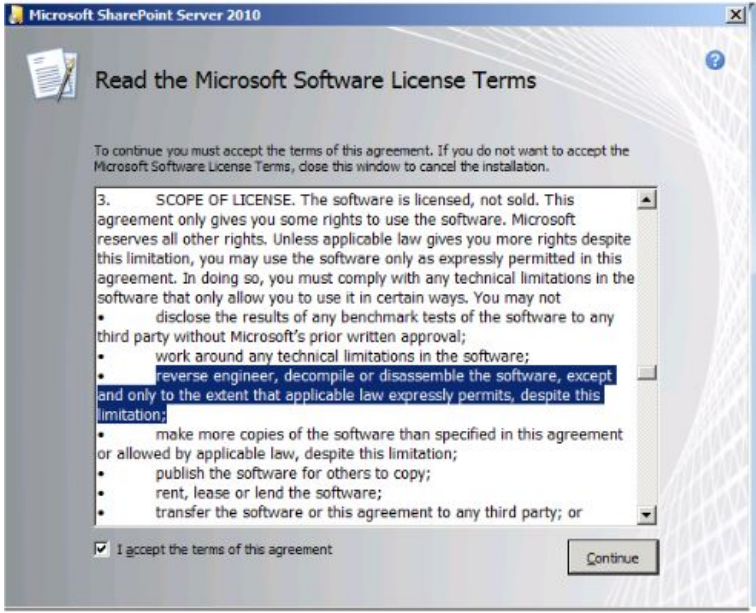


Reverse engineering for military applications

- Tupolev Tu-4
- V2 Roketi

Is it Legal?

- **Grey area**
- **EULA, Copyright, DMCA, Trade Secret Law**
- **https://www.eff.org/tr/issues/coders/reverse-engineering-faq**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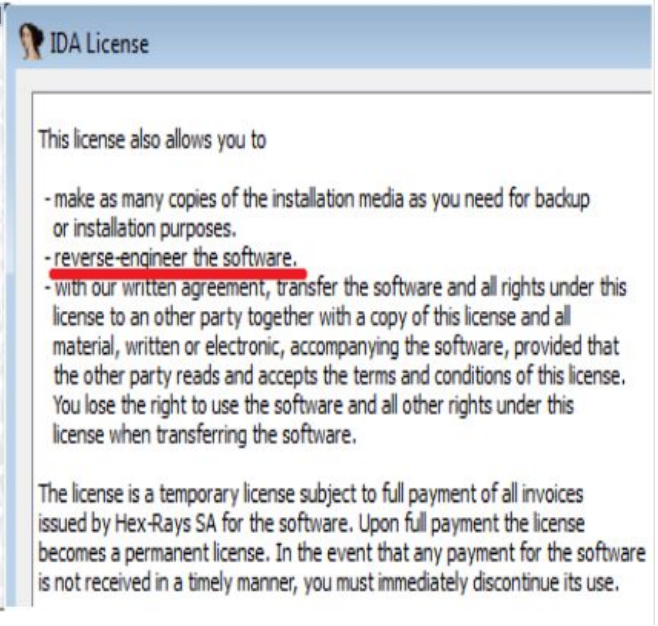
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