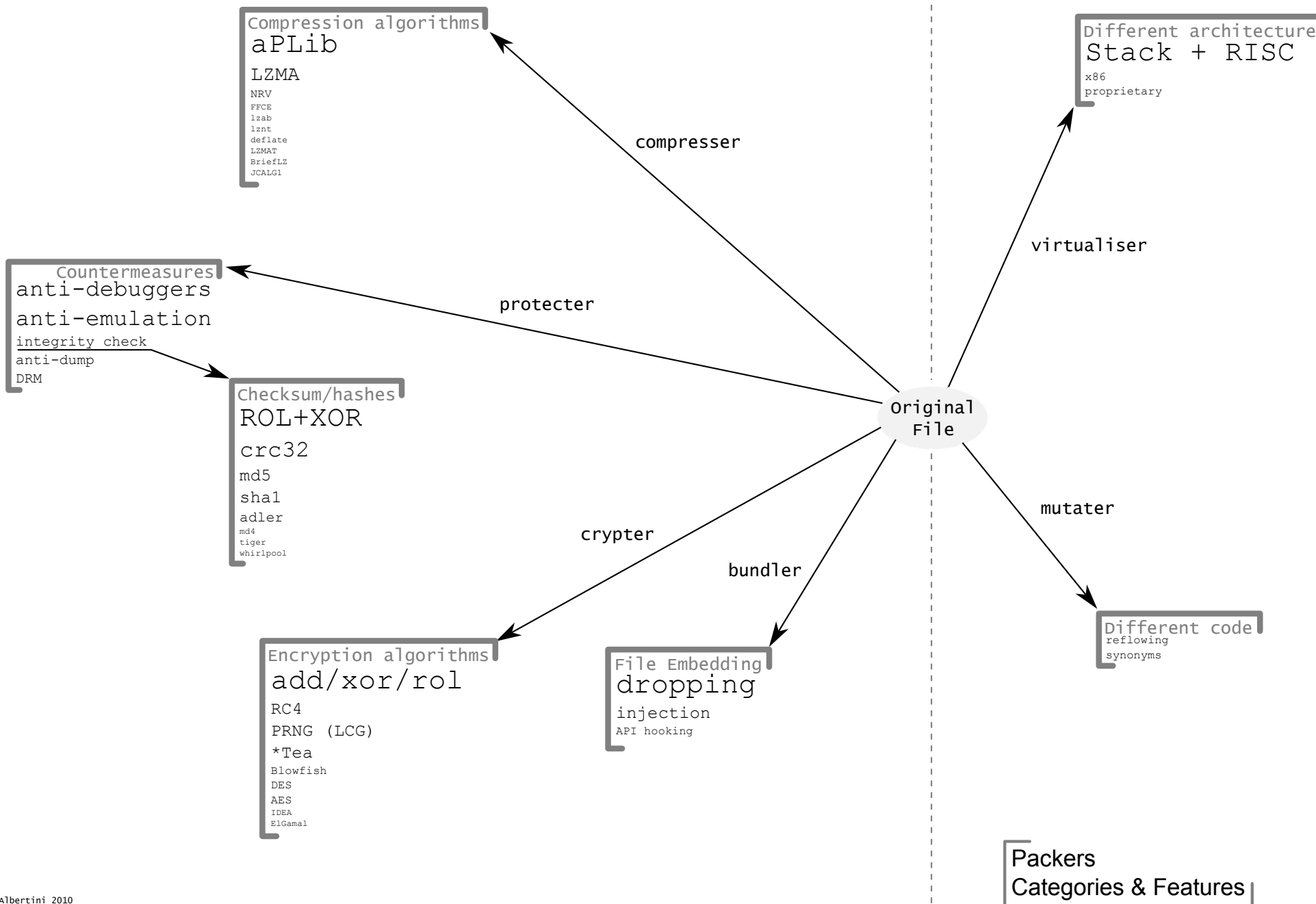


Packers Models

anti-analysis
 anti-debugger
 anti-emulation

extension
(extra packer code is executed)

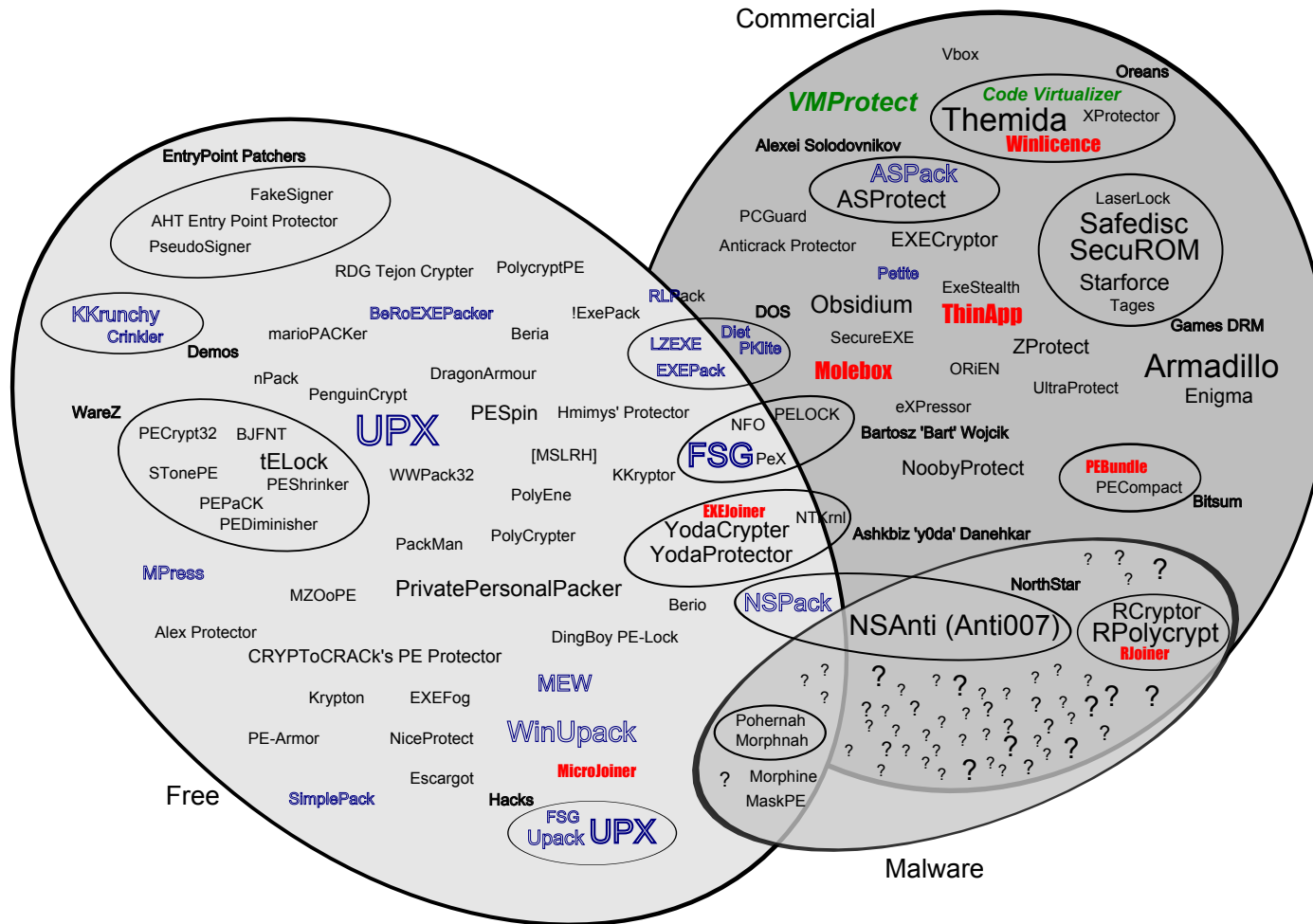
transformation
(original code is rewritten)



Packers
Categories & Features

Packers Landscape

Bundlers
Virtualisers
Compressors



compression	(used on top of compression algorithms)
section merging	merge all sections (just one entry in the section table)
imports	imports are stored and loaded with a more compact import table format
imports by hash	exports are parsed until it matches a specific hash, instead of a <i>GetProcAddress</i> call
call optimisation	turn relative operands of jumps and calls into absolute → better compression
resources	compresses resources, avoiding critical ones (main icon, manifest,...)
protection	
token check	presence check to allow the program to run: dongle, CD/DVD, key, file, network...
fingerprinting	token is specific to a hardware element: disk/OS/CPU/MAC/...
demo mode	inclusion of a demo binary/mode that is executed when token is absent or not enough privileged
integrity	check the contents are unmodified with checksum or hash
anti-analysis	
overlap	jumping after the first byte of an instruction
illusion	makes the analyst the something incorrect happened
junk	insertion of dummy code between relevant opcodes
jumps	insertion of jumps to makes analysis visually harder
polymorphism	different but equivalent code → 2 packed files of the same source are different
self generation	packer stub generates polymorphic code on the fly → same file executes differently
virtualization	virtualizes (part of) packer stub code → harder analysis
stack	strings are built and decrypted before use, then discarded → to avoid obvious references
faking	add fake code similar to known packers to fool identification
thread	use several parallel threads to make analysis harder
timing	comparing time between two points to detect unusual execution
anti-debugging (and anti-tools, by extension)	
detect	detect the presence of an attached debugger: IsDebuggerPresent
prevent	prevent a debugger to attach to the target itself or stay attached
nuisance	make debugger session difficult: BlockInput, slow down...
thread	spawn a monitoring thread to detect tampering, breakpoints, ...
artifacts	detects a debugger by its artifact: window title, device driver, exports, ...
limitation	prevent the use of a tool via a specific limitation
exploit	prevent the use of a tool via a specific vulnerability
backdoor	detect or crash a debugger via a specific backdoor
self-debugging	debug itself to prevent another debugger to be attached
int1	block interruption 1 → debuggers stop working
fake	add code of known packer to fool identification
anti-dumping (prevent making a working executable from a memory image)	
tampering	erase or corrupt specific file parts to prevent rebuilding (header, packer stub,...)
imports	add obfuscation between imports calls and APIs (obfuscation, virtualization, stealing, ...)
on the fly	API address is resolved before each use to prevent complete dumping
API hooking	alter API behavior: redirect benign API to a critical one → dump not working
inlining	copy locally the whole content of API code → no more 'import calls'
relocate	relocate API code in separate buffer → calls don't lead to imported DLLs
byte stealing	move the first bytes of the original code elsewhere → harder rebuilding and bypasses breakpoints
page guard	blocks of code are encrypted individually, and decrypted temporarily only upon execution
flow	flow opcodes are removed and emulated (or decrypted) by the packer during execution → incorrect dump
virtualization	virtualizes (part of) original code, API start... → dump not working without VM code
anti-emulation	
opcodes	using different opcodes sets (FPU, MMX, SSE) to block emulators
undoc	use of rare or undocumented opcodes to block non-exhaustive emulators
API	unusual APIs are called to block non-exhaustive emulators (anti-virus)
loop	extra loops are added to make time-constraint emulators give up
bundlers	
drop	original file is written to disk then executed
injection	original file is injected in existing process → no new file on disk + higher privileges
hooking	file handling APIs are modified to make embedded files usable like external ones

PECOMPACT

EntryPoint:

```
mov eax, _1
push eax
push dword ptr fs:[0]
mov fs:[0], esp
xor eax, eax
mov [eax], ecx
```

[...]

```
_1:
mov eax, <random1>
lea ecx, [eax + <random2>]
mov [ecx + 1], eax
mov edx, [esp + 4]
mov edx, [edx + c]
mov byte ptr [edx], 0e9
add edx, 5
sub ecx, edx
mov [edx - 4], ecx
xor eax, eax
retn
```

```
mov eax, 12345678
pop dword ptr fs:[0]
add esp, 4
push ebp
push ebx
```

MEW

```
_1:
mov esi, <address>
mov ebx, esi
lods
lods
push eax
lods
xchg eax, edi
mov dl, 80
```

```
_2:
movsb
mov dh, 80
call [ebx]
jnb _2
```

[...]

EntryPoint:

```
jmp _1
```

FSG

EntryPoint:

```
xchg [_1], esp
popad
xchg eax, esp
push ebp
```

_1:

```
movsb
mov dh, 80
call [ebx]
jnb _1
xor ecx, ecx
call [ebx]
```

UPX (LZMA)

EntryPoint:

```
pushad
mov esi, <address>
lea edi, [esi + <negative>]
push edi
mov ebp, esp
lea ebx, [esp - 3E80]
xor eax, eax
```

_1:

```
push eax
cmp esp, ebx
jnz _1
inc esi
inc esi
push ebx
push 0C478
push edi
add ebx, 4
push ebx
push 534E
push esi
add ebx, 4
push ebx
push eax
mov dword ptr [ebx], 2003
nop
nop
nop
nop
push ebp
push edi
push esi
push ebx
sub esp, 7C
mov edx, [esp + 90]
```

UPX

EntryPoint:

```
pushad
mov esi, <address>
lea edi, [esi + <negative>]
push edi
or ebp, ffffffff ; * Not in UPX >3
jmp $ + 12
nop
nop ; *
nop ; *
nop ; *
nop ; *
nop ; *
mov al, [esi]
inc esi
mov [edi], al
```

ASPack

EntryPoint:

```
pusha
call _1
db 0E9h ; E9 EB045D45 CALL ...
jmp _2
_1:
pop ebp
inc ebp
push ebp
retn
_2:
call _3
db 0EBh ; EB54 JMP <garbage>
_3:
pop ebp
```

Packers
EntryPoints

upack

EntryPoint:

```
mov esi, <address>
lods
push eax
push dword ptr [esi+34]
jmp short _1
[...]
```

```
_1:
push dword ptr [esi+38]
lods
push eax
mov edi, [esi]
mov esi, <address2>
```

APLIB

```

start:
    pushad
    mov esi, [esp + 24]
    mov edi, [esp + 28]
    cld
    mov dl, 80
    xor ebx, ebx

>copy_literal:
    movsb
    mov bl, 2

>next:
    call getbit
    .....
    jnb short copy_literal
    xor ecx, ecx
    call getbit
    [...]
    sub esi, eax
    rep movsb
    pop esi
    jmp next

getbit:
    add dl, dl
    jnz skip
    mov dl, [esi]
    inc esi
    adc dl, dl

skip:
    retn

[...]

end:
    sub edi, [esp + 28]
    mov [esp + 1c], edi
    popad
    retn 0c

```

Packers
Algorithms

LZMA

```

start:
    push ebp
    mov ebp, esp
    add esp, -54
    push ebx
    push esi
    push edi
    mov [ebp - c], ecx

[...]

$+84:
    add ecx, [ebp - 34]
    mov eax, 300
    shl eax, cl
    add eax, 736
    dec eax
    test eax, eax
    jb no_init
    inc eax
    mov [ebp - 2c], 0

init_buffer:
    mov edx, [ebp - 10]
    mov ecx, [ebp - 2c]
    mov [edx + ecx * 4], 400
    inc [ebp - 2c]
    dec eax
    jnz init_buffer

no_init:
    [...]

    mov al, 1
    pop edi
    pop esi
    pop ebx
    mov esp, ebp
    pop ebp
    retn 10

```

CRC32

```

crcloop:
    test eax, 1
    jz no_xor
    shr eax, 1
    xor eax, 0EDB88320h
    jmp loop

no_xor:
    shr eax, 1

loop:
    loop crcloop

```