PA193 Secure coding principles and practices

Overview of the subject

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CR CS
Centre for Research on
Cryptography and Security

PA193 Secure coding principles and practices

- Secure coding
  - How to write code in a more secure way
  - So that the program is harder to be attacked/exploited
  - Selected basic building blocks of security applications
- 2/2/2
  - Lecture: 2 hours weekly
  - Seminar: 2 hours weekly
  - Homework: about 6-? hours/each
  - Project: about 30-40 hours/person

People

- Main contact: Petr Švenda (CRoCS@FI MU)
  - Office hours: Tuesday 13:00-13:50, A406
  - svenda@fi.muni.cz, @rngsec
  - https://crocs.fi.muni.cz/people/svenda
- Petr Ročkai (FI MU)
  - Office hours: Tuesday 12:00-12:50, A406
  - xrockai@fi.muni.cz
- Other lectures and seminars
  - Milan Patnaik (DRDO) Marek Sýs (FI), Kamil Dudka (RedHat), Mirek Jaroš (RedHat), Martin Ukrop (FI)

Previous knowledge requirements

- Basic knowledge of (applied) cryptography and IT security
  - symmetric vs. asymmetric cryptography, PKI
  - block vs. stream ciphers and usage modes
  - hash functions
  - random vs. pseudorandom numbers
  - basic cryptographic algorithms (AES, DES, RSA, EC, DH)
  - risk analysis
- Basic knowledge in formal languages and compilers
- User-level experience with Windows and Linux OS
- **Practical experience with C/C++/Java language**

Organization

- Lectures + seminars + assignments + project + exam
- Assignments
  - 8 homework assignments (+ bonus)
  - **Individual work of each student**
  - Lab A403 available to students (except teaching hours)
- Project
  - **Team work** (2-3 members)
  - Details next week (CI, fuzzing and sanitizers for OS project)
- Exam
  - Written exam, open questions, pencil-only

Grading

- Credits
  - 2+2+2 credits, plus 2 for the final exams
- Points [Notice minimal number of points required!]
  - Homework (40) – [minimum 20 required]
  - Project (20) – [minimum 10 required]
  - Written exam (50) – [no minimum limit]
  - Occasional bonuses ☺
- Grading 110 (max)
  - A ≥ 100
  - B ≥ 90
  - C ≥ 80
  - D ≥ 70
  - E ≥ 55
  - F < 55

Attendance

- Lectures
  - Attendance not obligatory, but highly recommended
- Seminars
  - Attendance **obligatory**
  - Absences must be excused at the department of study affairs
  - 2 absences are OK (even without excuse)
- Assignments and projects
  - Done during students free time (e.g. at the dormitory)
  - Access to network lab and CRoCS lab is possible

Discussion forum in Information System

- Discussion forum in Information System (IS)
  - https://is.muni.cz/auth/cd/1433/podzim2018/PA193/
- Mainly for discussion among the students
  - Not observed by stuff all the time!
  - Write us email if necessary
- What to ask?
  - OK to ask about ambiguities in assignment
  - NOT OK to ask for the solution
  - NOT OK to post your own code and ask what is wrong

Plagiarism

- Homeworks
  - Must be worked out independently by each student
- Projects
  - Must be worked out by a team of 3 students
  - Every team member must show his/her contribution
- Plagiarism, cut&paste, etc. is not tolerated
  - Plagiarism is use of somebody else words/programs or ideas without proper citation
  - Automatic tools used to recognize plagiarism
  - If plagiarism is detected student is assigned -7 points
  - More serious cases handled by the Disciplinary committee

Reuse of existing code

- Code reuse is generally great thing, but..
- NOT in homework or assignments!
- It is NOTOK:
  - Take any code from web when you should create code completely on your own (project - parser)
  - Share code of your solution with others (homework)

Left panel (12/11/2015 11:27:15, 4,135 bytes, C,C++,C#,ObjC Source, ANSI, PC):

```c
int bitrates[] = {
    BITRATEFREE, BITRATEFREE, BITRATEFREE, BITRATEFREE, BITRATEFREE,
    32,  32,  32,  32,    8,
    64,  48,  40,  48,   16,
    96,  56,  48,  56,   24,
    128,  64,  56,  64,   32,
    160,  80,  64,  80,   40,
    192,  96,  80,  96,   48,
    224, 112,  96, 112,   56,
    256, 128, 112, 128,   64,
    288, 160, 128, 144,   80,
    320, 192, 160, 160,   96,
    352, 224, 192, 176, 112,
    384, 256, 224, 192, 128,
    416, 320, 256, 224, 14
    448, 384, 320, 256, 1
    BITRATEBAD, BITRATEBAD,        TEBAD, BITRATEBAD, BITRATEBAD
};

typedef struct{
```

Right panel (18/11/2015 16:40:53, 11,086 bytes, C,C++,C#,ObjC Source, ANSI, UNIX):

```c
int bitrates[] = {
    BITRATEFREE, BITRATEFREE, BITRATEFREE, BITRATEFREE, BITRATEFREE,
    32,  32,  32,  32,    8,
    64,  48,  40,  48,   16,
    96,  56,  48,  56,   24,
    128,  64,  56,  64,   32,
    160,  80,  64,  80,   40,
    192,  96,  80,  96,   48,
    224, 112,  96, 112,   56,
    256, 128, 112, 128,   64,
    288, 160, 128, 144,   80,
    320, 192, 160, 160,   96,
    352, 224, 192, 176, 112,
    384, 256, 224, 192, 128,
    416, 320, 256, 224, 144,
    448, 384, 320, 256, 160,
    BITRATEBAD, BITRATEBAD, BITRATEBAD, BITRATEBAD, BITRATEBAD
};

typedef struct{
    ////  unsigned      framesync    :12;     //Frame synchronizer
```

Lower left panel (12/11/2015 11:27:15, 4,135 bytes, C,C++,C#,ObjC Source, ANSI, PC):

```c
int readMP3header(FILE *f, MP3HEADER *h){

    MP3ID3TAG2 tag;

    //push file point to the beginning

    rewind(f);
    fread(&tag, 1, sizeof(MP3ID3TAG2), f);

    //tag id3v2 are located at the beginning of file, id3v1 at the end
    if(tag.tagid[0]=='I' && tag.tagid[1]=='D' && tag.tagid[2]=='3'){//is
        fseek(f, unpacktagsize(tag), SEEK_CUR);

    }else{//isn't tag id3v2 - go back
        rewind(f);
    }

    //I'm currently not interested in the final state of the file pointe
```

Lower right panel (/11/20.. 6:40:53, 11,086 bytes, C,C++,C#,ObjC Source, ANSI, UNIX):

```c
  t ReadMP3Header(FILE *f, MP3HEADER *h, unsigned int StartFlag, uint16_t fra
    uns      ha  head[4] ;
    int  ont ;
    MP3ID3TAG2  ag
    int lc = 0;

    if ( StartFlag == 1
    {
        rewind(f);    ///// set file pointer to beginning of file
        fread(&tag, 1, sizeof(MP3ID3TAG2), f);

        //// Check for the tag id3v2 is preasent at the beginning of file,
        if(tag.tagid[0]=='I' && tag.tagid[1]=='D' && tag.tagid[2]=='3')
            { ////  if tag id3v2 is present then jump to end of tag
            fseek(f, unpacktagsize(tag), SEEK_CUR);

            printf("\nFile Has Id3Tag2 Present At Begining");
        }
        else{   //// if tag idv3 isn't present then go back to begining of fi
            rewind(f);
        }
    }
```
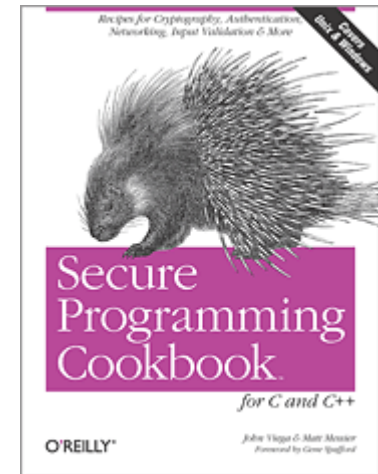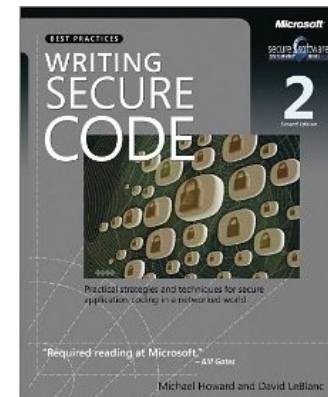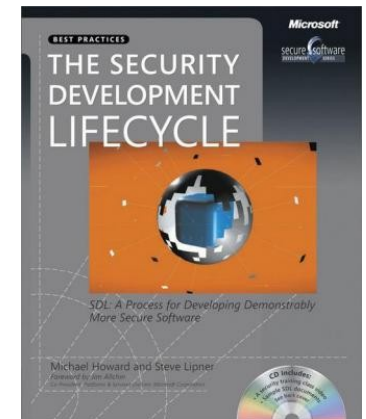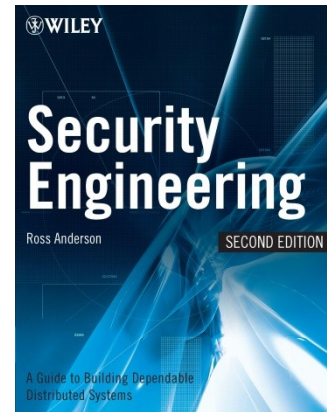

Example of Plagiarism

Course resources

- Lectures (PDF) available in IS
  - IS = Information System of the Masaryk University
  - https://is.muni.cz/auth/el/1433/podzim2018/PA193/
- Homeworks/assignments available in IS
  - Submissions also done via IS (Homework vaults)
- Additional tutorials/papers/materials from time to time will also be provided in IS
  - To better understand the issues discussed
- Recommended literatures
  - To learn more …

Recommended literature

- Ross Anderson - Security engineering, Wiley
- Michael Howard, Steve Lipner - Secure Development Lifecycle, MS Press
- John Viega, Matt Messier - Secure programming cookbook, O'Reilly
- Michael Howard - Writing secure code, MS Press

Questions ?