ON SOFTWARE TESTING

THEMATIC EXCELLENCE PROGRAM 2019
INDUSTRY AND DIGITALISATION
APPLICATION DOMAIN SPECIFIC HIGHLY RELIABLE IT SOLUTIONS

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HUNGARY

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Why we need reliable testing?

- **Some painful SW bugs from the past**
  - People died
    - Therac-25, 1982; NCI, Panama City, 2000
    - Patriot Missile, 1991
  - Huge money loss
    - Ariane 5 Flight 501, 1996, $500 billion project
    - EDS Child Support System, 2004, $1 billion loss for UK taxpayers
    - Bitcoin exchange hack, 2011, $0.5 billion loss
    - Trading SW „Knight”, 2011, $440 million in 30 mins, etc.

https://www.cigniti.com/blog/37-software-failures-inadequate-software-testing/

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Why we need reliable testing?

- **Bugs from year 2019 (avionics)**
  - Airbus A350
    - Pilots get the wrong fuel consumption of data
    - Cabin pressure and air system oxygen supply controls fail
    - Wing-ice protection systems become inoperable
    - Landing gear operations, both extension, and retraction no longer work
  - Boeing 737 Max 8
    - A bug in the microprocessor in the flight control computer results in maneuvering problems causing system safety risk

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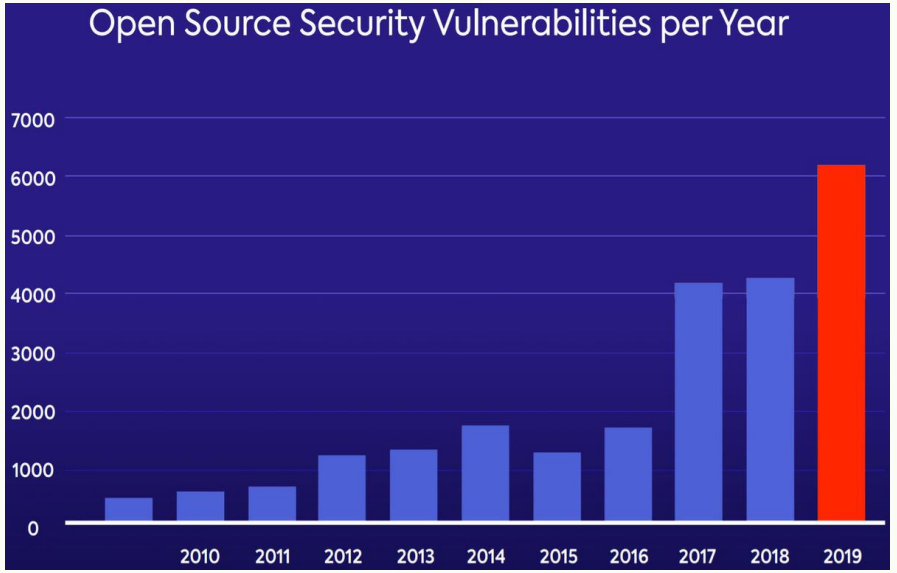
Why we need reliable testing?

- **Bugs from year 2019 (everyday SW)**
  - Operating system vulnerabilities
    - Android, 414
    - Debian Linux with 360, and
    - Windows 10 with 357 reported bugs
  - Known open-source SW vulnerabilities has risen to 6100, up from 4100 previous year



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Importance of testing

”We have a simple message for all countries: test, test, test.”

– WHO director Tedros Adhanom, 16th of March, 2020

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Our research target

- Why the present software testing methodologies/practices/theories are not sufficient?
- What can we do? How can we **build and test** domain specific highly reliable IT solutions?
- We concentrated on two subfields:
  - Development and testing at large scale
  - Effective and efficient test design

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Developing and testing at large scale

- How are IT systems scaling (especially test sytems)?
- What has the biggest impact on the quality of large scale IT systems?
- How to select test cases when various target parameters are given (coverage, running time, dependencies, etc.)?
- What are the effects on the quality of IT systems during their evolution?
- How to scale Agile (DevOps/CI)?

http://compalg.inf.elte.hu/~attila/DevAndTest_at_scale.html

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Test Design Manifesto

Conscious methodologies	Justified methodologies	over	Ad-hoc methodologies
Multiple techniques	Combined techniques	over	Single technique
Efficiency	Linear techniques	over	Non-linear techniques
Risk analysis	Cost & quality optimized test design	instead of	False trade-off between cost & quality
Automation	Automated techniques	instead of	Manual techniques
Synergies between industry & academia	Harmonizing academic & industrial results	instead of	Separate living close to each other

www.test-design.org

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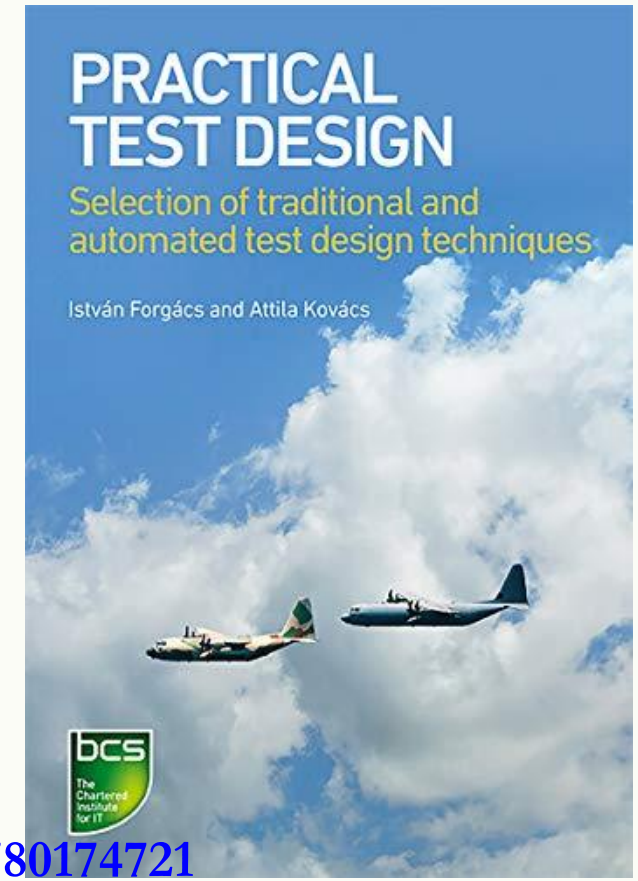
Book on Practical Test Design

- Using risk analysis and historical data it is possible to optimise the cost and quality
- Based on risk analysis it is possible to select the most appropriate test design techniques (EP, BVA, EFSM-based, business-rule based, session-based, combinative and combinatorial models, etc.)
- Test design can be automated



https://www.amazon.com/Practical-Test-Design-traditional-techniques/dp/1780174721

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Why all of these are interesting?

- Complex IT solutions are hard to scale up.
- We need efficient and effective quality assurance in all of our highly reliable IT projects independently of the domain.

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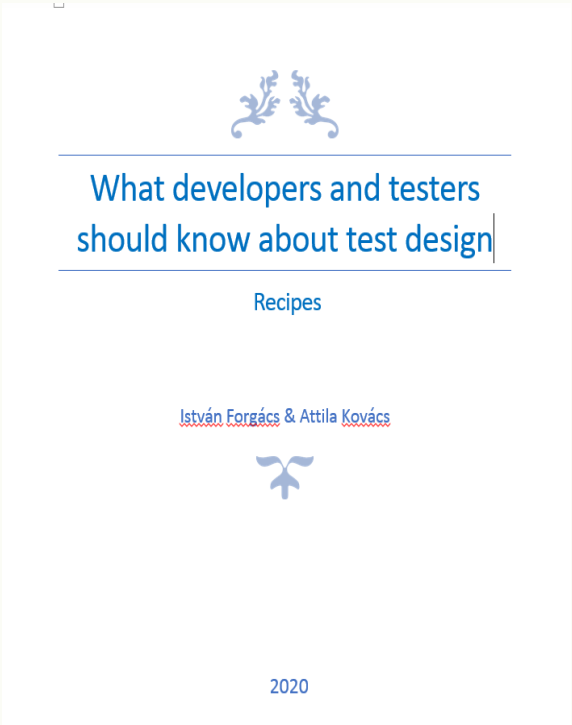
Further plans

- Researching **scalable quality solutions** for various domains
- Researching new techniques for BVA, EFSM based testing by which **more reliable and cheaper** testing can be performed



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Application domain specific highly reliable IT solutions
https://tinyurl.hu/fDuY/

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