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Computer Science

Current state

by Stanislav Protasov

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Agenda

- Who's that guy in front of you?
- What is CS: areas and specialization
  - Engineering
  - Science
  - Analysis
- Where to study

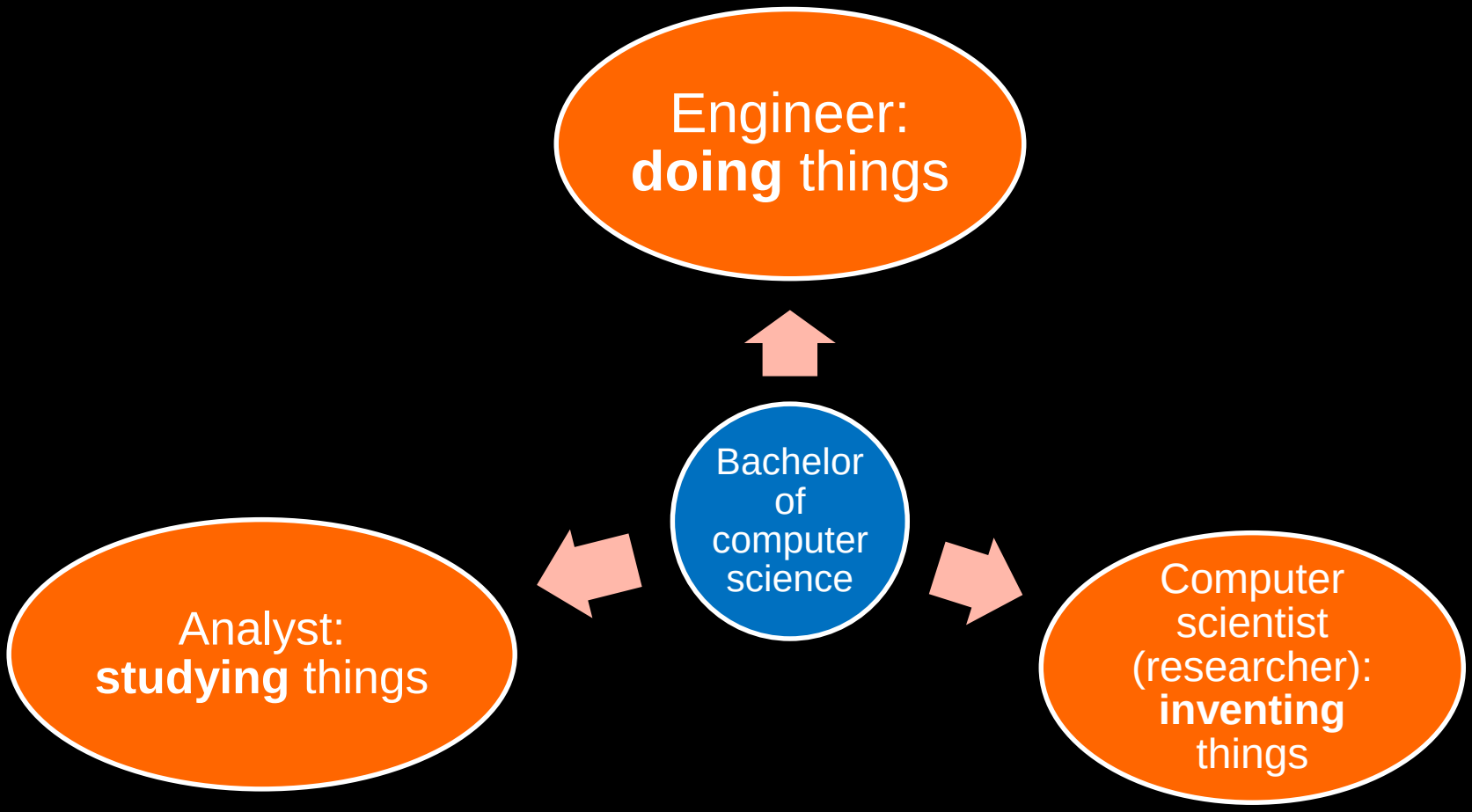
Who's there?

- 2013 – Cand. Sc. (computer vision)
- 2007-2015 – software developer (engineer)
  - …, DHL Express, Parallels, …
- 2010-now – university teacher, researcher
  - Voronezh State University, MIEM (HSE), MIPT
  - 2015-now – Innopolis University

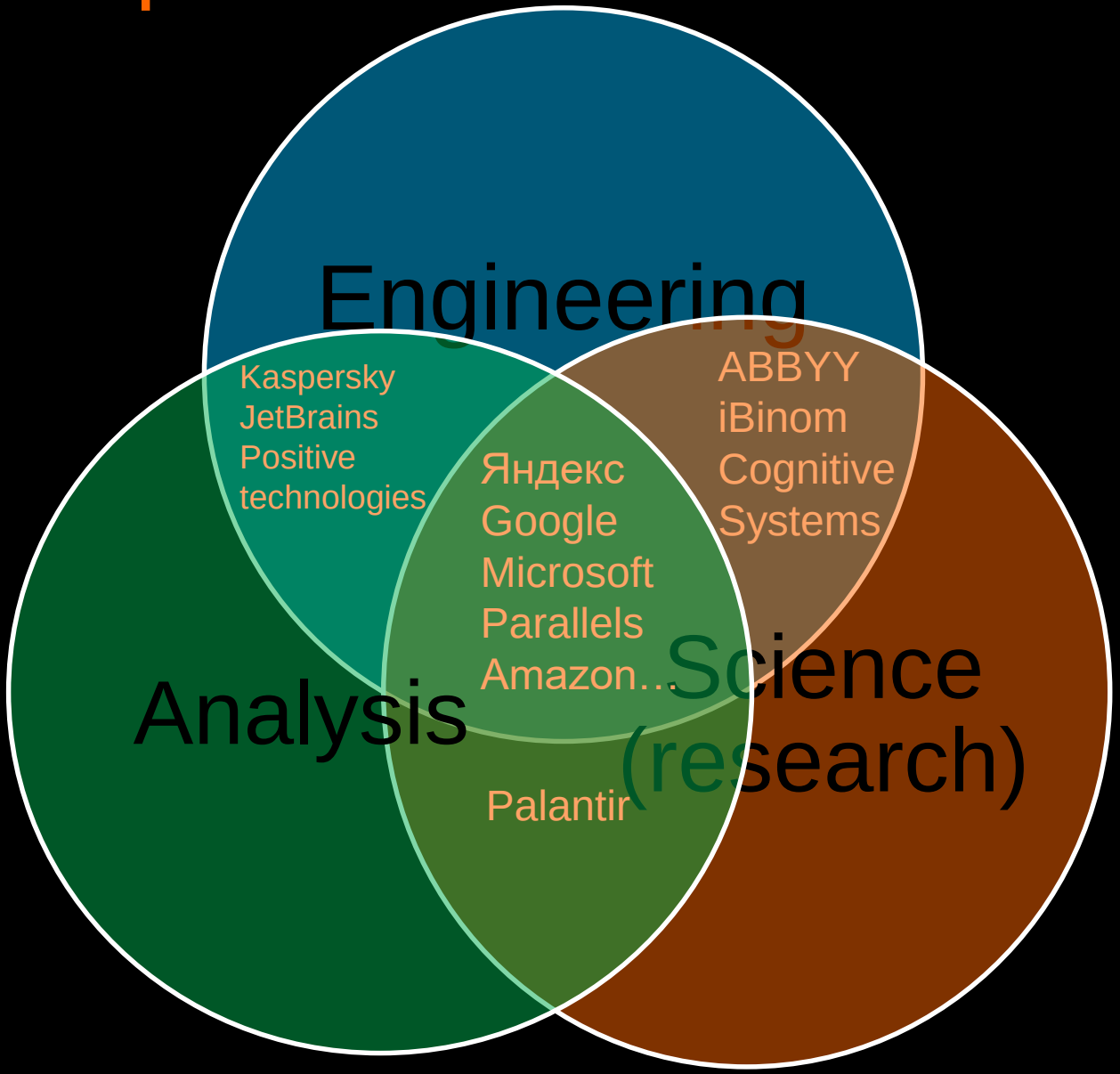
Computer science

- Solving problems with help of computer
  - Information transfer, storage and *processing*
  - Finding answers for complex questions
- Improving computers and systems to solve more complex problems
  - Faster processors, networks, algorithms
  - New discrete architectures (GPUs, caches, …)
  - Quantum computers and communication
  - …

Specialization



Specialization: in fact



Areas of the future (by HSE)

- Cloud Technologies (SDN)
- Wireless Networks
- Data Science & Big Data
- Mobile
- Security

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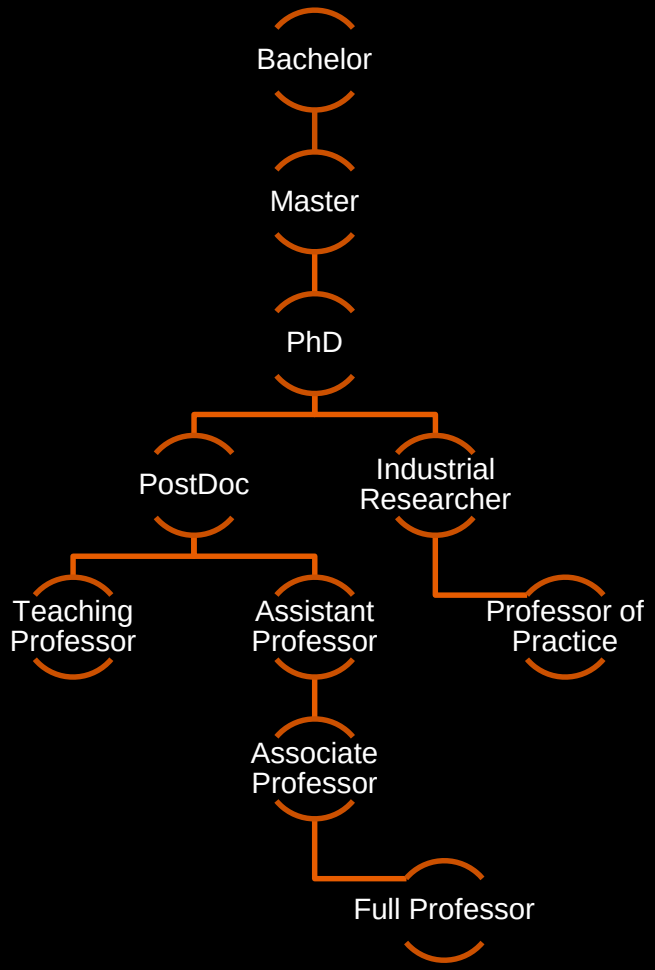
RESEARCH

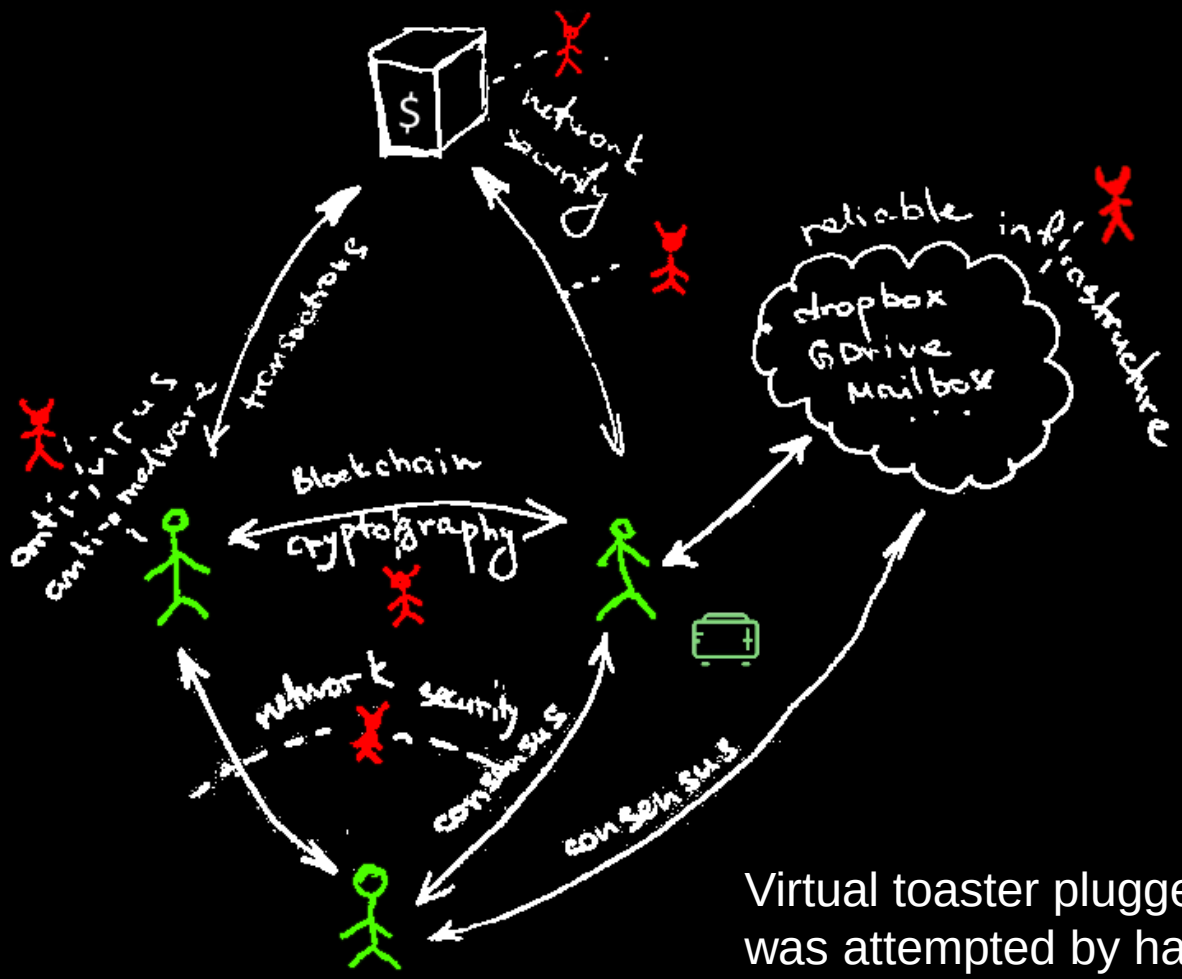
Track


Bachelor
Master
PhD
PostDoc
Industrial Researcher
Teaching Professor
Assistant Professor
Professor of Practice
Associate Professor
Full Professor

Research

- Distributed and cloud systems, networks, cryptography, security
- Machine Learning and Data Analysis
- Software Architecture and Engineering
- Robotics (personal and industrial)
- Hardware Architectures
- Computer Vision
- Algorithms
- …

Data storing and sending



Virtual toaster plugged into Internet was attempted by hacker in 41 minutes

Education

- MIT, CalTech, CMU, Berkley
- University of Amsterdam (UvA)
- Бауманка, ИТМО, МИФИ, ФУПМ МФТИ, Innopolis University

Machine Learning and Data Analysis

- Data analysis – learning facts from data
  - *only 5% of the data is somehow analyzed
- Machine learning – learning knowledge from data
  - Video
  - Another video

Machine Learning and Data Analysis

- ML
  - Image/video understanding
  - New HCI ways
  - Automatic translation
  - Healthcare
  - …
- DA
  - Spam detection
  - Trading bots
  - Fraud detection
  - Trends, forecasts
  - …

Education

- Stanford, MIT
- ВШЭ, СПбГУ, ИТМО, Innopolis University

Software architecture and engineering

- There are lots of systems already developed
  - And they all have problems
- How to build reliable product (say, airplane) in estimated time, according to requirements with known budget?
  - Management process
  - Quality Assurance (QA)
  - Artefact analysis
  - Planning
  - Tools, formal verification methods
  - …

Why?

- At least 2 people died because of Therac-25 radiation therapy machine (1982-1987)
- Ariane-5: $370M for integer overflow (1996)
- NASA lost its $125M Mars Climate Orbiter because spacecraft engineers failed to convert from English to metric measurements (1999)
- …

Education

- CMU (Carnegie Mellon University)
- Innopolis University, ВШЭ

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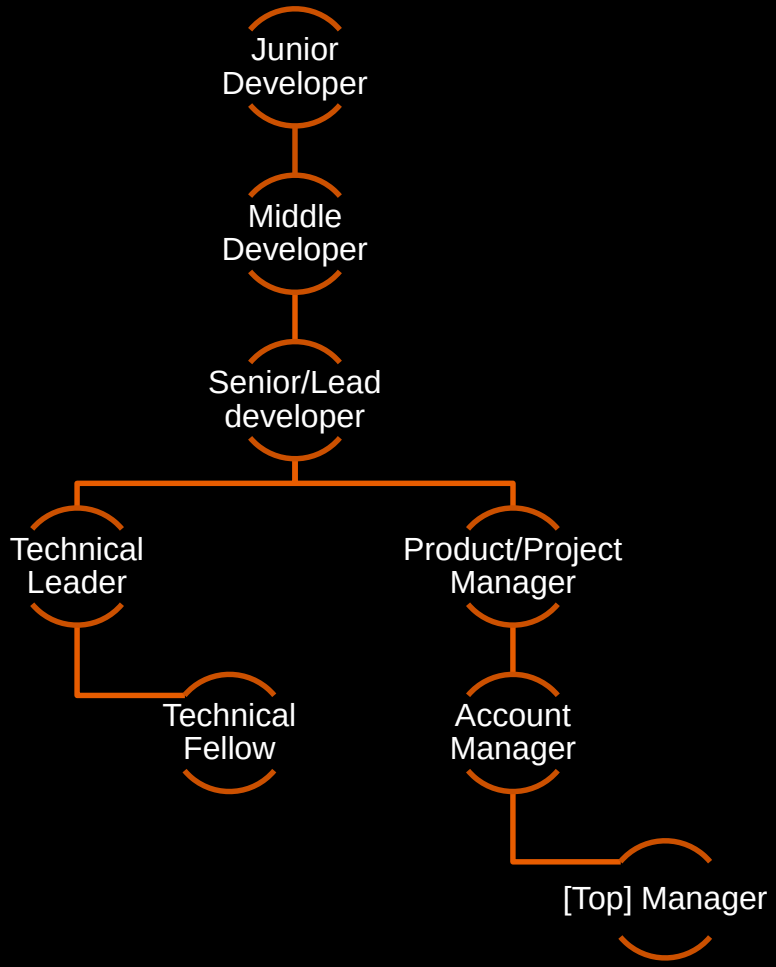
ENGINEERING

Track


Junior Developer
Middle Developer
Senior/Lead developer
Technical Leader
Product/Project Manager
Technical Fellow
Account Manager
[Top] Manager

Engineering by technologies

- Hardware development
- Server development
  - Big data engineer
- Mobile & embedded development
  - Wearable
  - IoT
- Web development
  - Full-stack developer

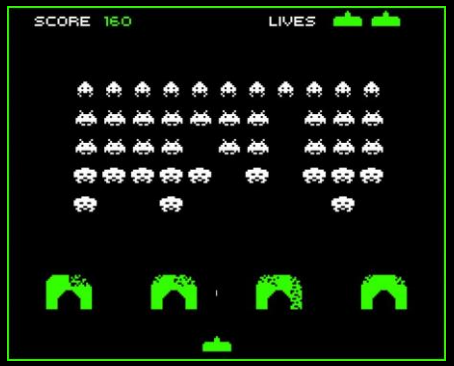
Engineering by approach

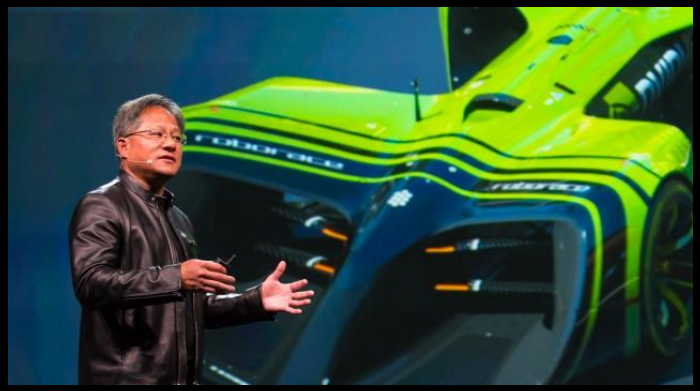
- Product development
  - Game development
  - Operating systems
  - Tools
  - …
- Outsourcing
- Freelancing
- Applied
  - Medical, industrial, *internal*

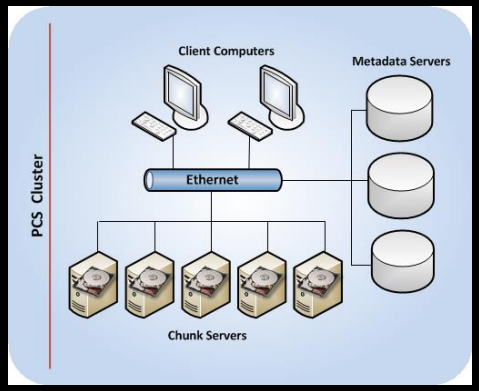
Engineering success

- Kaspersky (Eugene Kaspersky)
- Nginx (Igor Sysoev)
- Microsoft
- Facebook
- Google*
- …

Research is moving from universities to companies!







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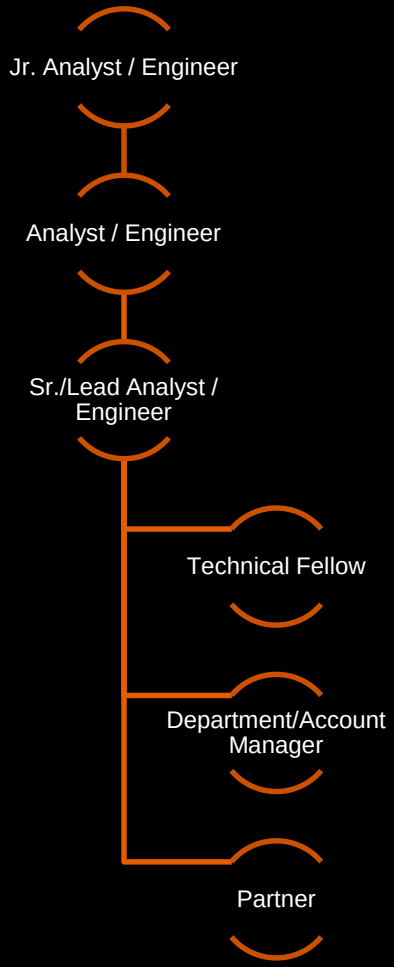
ANALYSIS

What to analyze?

- Quality Assurance and support
  - Any software company (Amazon, Parallels, Yandex, …)
- Business analytics and consulting
  - Accenture, PWC, KPMG, … / КРОК, Ланит, IBS
- Security analytics and audit
  - Infrastructure audit
  - Penetration testing
  - Reverse engineering

  - Intelligence, Positive Technologies, Kaspersky

Track


Jr. Analyst / Engineer
Analyst / Engineer
Sr./Lead Analyst / Engineer
Technical Fellow
Department/Account Manager
Partner

Examples

- Positive Technologies and Kaspersky run multiple security investigations every year
  - Kaspersky works with Interpol to bring down botnets
  - … and catches cybercriminals
  - “Positive” makes vulnerability reviews
- Open Web Application Security Project (OWASP) builds a rating of most widely found vulnerabilities

Other Examples

- Customer Experience Program (CEP) reports analysis
- Artefact and process analysis for automation
- Infrastructure analysis for danger detection and optimization

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- ВШЭ

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SUMMARY

Few steps to success

- Start with good bachelor degree in computer science (CS, ПММ, ВМК, …)
- Select promising problem/area at senior courses
- Either practice or do master's
  - But don't stop learning new things!
- If you like academia – get PhD in recognized university in promising area

So Long, and Thanks for All the Fish

- http://sprotasov.ru/files/cs.pdf
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