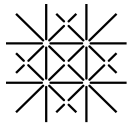

University of Basel

Center for Innovative Finance

Smart Contracts and Decentralized Finance

Intro: Welcome to the Course

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University of Basel

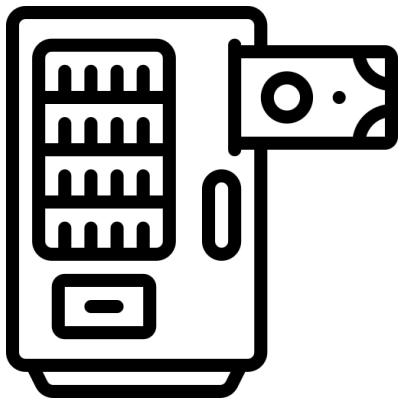
Release Ver.: (Local Release)
Version Hash: (None)
Version Date: (None)

Content Overview

1. **Introduction and Blockchain Fundamentals**
   Recap of basic blockchain building blocks.
2. **Ethereum Basics**
   The specifics of the Ethereum as Smart Contract platform.
3. **Smart Contract Programming**
   Hands-on introduction to the basics of Smart Contract programming with emphasis on exercises.
4. **DeFi Overview**
   A short introduction to Decentralized Finance.
5. **DeFi Asset Layer**
   Tokenization from an economics and technological point of view.
6. **DeFi Protocol Layer**
   Overview of the DeFi ecosystem, key components and major protocol types.
7. **Discussion and Outlook**
   Discussion, outlook and some advanced topics.

Why Smart Contracts?

Vending Machines can be seen as predecessors of Smart Contracts [3, 4]. Agreements are automated and breach of contract is costly



Simple Vending Machine (Pseudo Code)

```
if(coin >= price) {
    dispenseBeverage();
    returnChange(coin - price);
} else {
    print("insufficient funds");
}
```

But:

- Trust based! Closed source → Contract is not observable.
- Execution environment, i.e., hardware under control of seller.

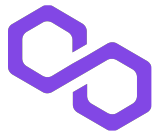
⇒ **Smart Contracts on public Blockchains address this.**

Popular Smart Contract Blockchains

Blockchains based on the Ethereum Virtual Machine (EVM):


Ethereum


BSC


Polygon


Tron


ETC

Non-EVM-based Blockchains:


Cardano


Solana


Polkadot


Avalanche


Algorand

This is a non-exhaustive list that will likely age very badly.

Why Ethereum / EVM?

All EVM-based blockchains share the same smart contract development languages.

Ethereum is currently THE dominant platform:

- Market Cap
- Economic Activity
- Developer Activity
- Community

Understanding Ethereum will help you to understand any protocol.

Electric Capital Developer Report 2020

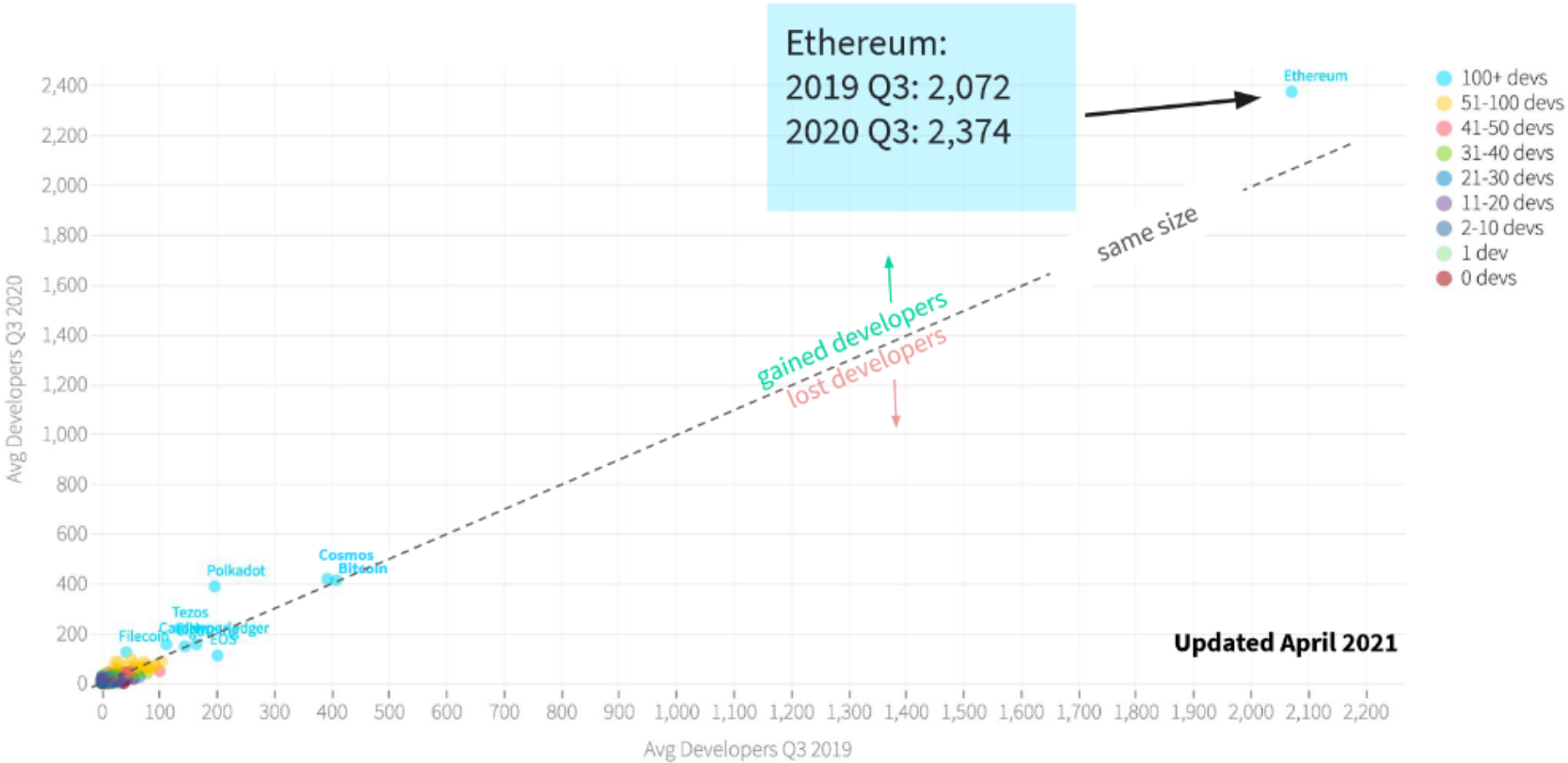


Figure: Electric Capital Developer Report 2020, p. 46 [1]

Why Decentralized Finance (DeFi)?

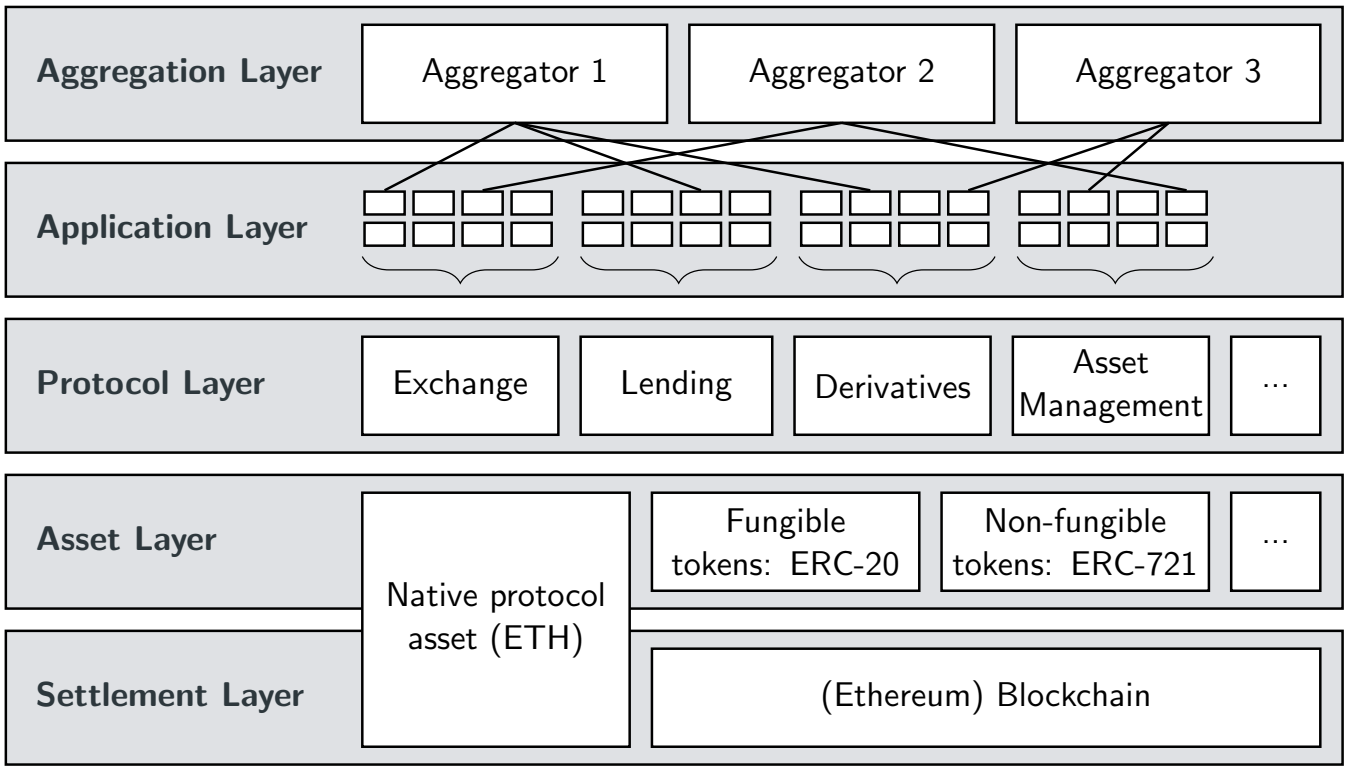
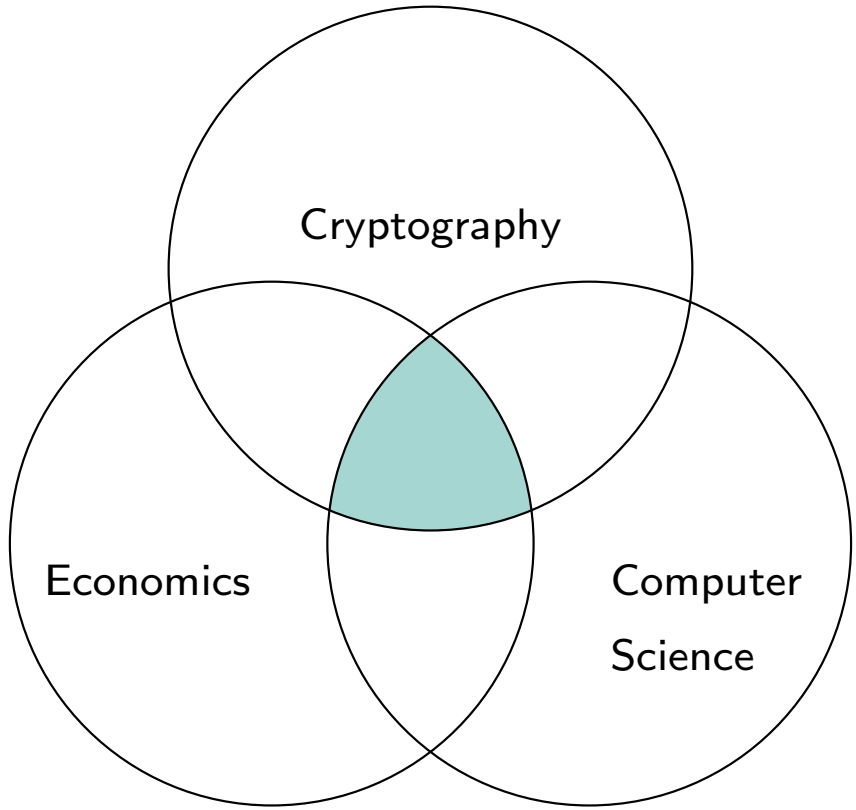


Figure: The DeFi Stack [2]

- Most mature and diverse smart contract-based ecosystem.
- Relevancy of applications from an economics perspective.

Interdisciplinaray Approach



Public Blockchains can only be fully understood, when they are studied from various perspectives. This is the reason why this course uses an **interdisciplinary** approach.

Programming and Computer Science Exposure

Programming Language

solidity

Tools

Atom

Remix

Integrated Development Environments

Github

Version Control

Ganache

Blockchain Management

Truffle

Metamask

Testing

Some Lecture Conventions

Basic Contract Structure (Solidity)

```
Pragma solidity ^0.8.7;
contract HelloWorld {
/* Instructions */
}
```

Sample Code Box
Contains code snippets in Solidity or pseudo code.

Key Takeaway

Transactions can be used to transfer value, interact with an existing smart contract and to deploy new smart contracts.

Key Take-Away
Highlights important concepts and definitions.

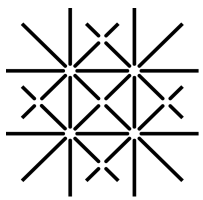
Exercise 1

Get Ropsten Ether from the faucet and deploy your first smart contract on Ropsten Testnet.

Exercises
Things for you to try out.

Part of Multi-Course Series

Blockchain courses have been part of the University of Basel's curriculum since 2017.



University of Basel

Center for Innovative Finance

- This is a University graduate-/ master-level course
- It is part of a series of courses
- Second course to switch to open lecture format

Three Options to Take This Course

The goal of our open lectures is to make teaching resources freely available. There are **three options** for taking this course:

	Videos	Platform	Quizzes	Group Project	ECTS
YouTube	✓				
Cryptolectures.io	✓	✓	✓		
University of Basel	✓	✓	✓	✓	✓

- YouTube Channel
- Cryptolectures.io
- University of Basel - General Information

Meet the Open Crypto Lectures Team

Professor

Fabian Schär

PhD Candidates

Tobias Bitterli

Mitchell Goldberg

Matthias Nadler

Katrin Schuler

Student Assistants

Lorenz Geering

Pirmin Özdemir

Jonas Ruchti

Dario Thürkauf

Information for University of Basel Students

Group Project (40% of final grade)

- Smart Contract programming project.
- Groups of 2-4 students.
- Date: see course directory or welcome email.

Exam (60% of final grade)

- 90 Minutes
- Closed book
- T/F, MC, Numbers and Text/Figure Boxes
- You may use a non-programmable calculator (↗ Rules)

References and Recommended Reading

[1] Electric Capital, *Developer report*, 2020.

[2] Fabian Schär, *Decentralized finance: On blockchain- and smart contract-based financial markets*, Review of the Federal Reserve Bank of St Louis **103** (2021), no. 2, 153–74.

[3] Nick Szabo, *Smart contracts*, 1994.

[4] _____, *The idea of smart contracts*, 1997.