OST Eastern Switzerland University of Applied Sciences

Blockchain (BICh)

HTLCs, Cross-chain Atomic Swaps

Thomas Bocek 18.11.2021

- A Showcase of Cross-chair Atomic Swaps
 - Either swap happens or becomes void





- Use case: I want to exchange my 1 BTC to 37 ETH
 - Obvious approach: use a centralized exchange, such as Binance, Bitstamp, or Kraken

 English 🧹 Crypto Markets	Continue Trade •	X Earn •											Log In
Binance	Will List COTI (C	OTI) - Deposit COT	I Fast for a	(02-25)	Binance La	unches 50,000 BNB Commur	nity Giveaway (02-21)	Binance V	Will List Commu	inity Coin V	ote Round 6 Winner	· (02-21)	
ETH / BTC		ast Price		24h Change		24h High	24h Low	24h Volum		<u>×</u> (🛧 M BNB	BTC ALTS V	FIAT
Ethereum	0	.026692 \$250.21		-0.001022	-3.69%	0.027772	0.026631	5,524.35	BTC		Q Search	 Change 	O Volume
	droups	6 decimals 🔻	Time m	▼ 1H ▼ 1D	1W 1M			Original Trad	lingView Dept	h 55	Pair 🔺	Price	Change
									Guine Dobe		ADA/BTC	5x 0.00000607	-0.82%
	Amount (ETH)	Total(BTC)					0.027799 >			0.027800		0.00000951	-3.74%
0.0267 50	30.000	0.80250000				é a l	i i i i i i i i i i i i i i i i i i i				AE/BTC	0.00002145	-2.94%
0.0267 49	0.692	0.01851031					·····································			0.027600	☆ AGI/BTC	0.00000254	-6.62%
0.0267 46	0.161	0.00430611			. i i i i i i i i i i i i i i i i i i i						☆ AION/BTC	0.00001321	-8.52%
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0.0267 39 0.0267 36	85.500	2.28618450							NT ++-	0.027200	☆ ANKR/BTC	0.00000021	-4.55%
0.026735	13.679 78.000	0.36572174		₩				' II.			☆ APPC/BTC	0.00000430	-8.12%
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0.026733	7.488	0.20017670						!'	· · · ·		☆ ARK/BTC	0.00002161	-10.74%
0.0267 27	0.403	0.20017870						· · · · · · · · · · · · · · · · · · ·	Ti	-0.026800	☆ ARN/BTC	0.00001497	-5.61%
0.026726	6.060	0.16195956							1	0.026692	☆ ARPA/BTC	0.00000121	-9.02%
0.026721	8.116	0.21686764							0.026631 >	-25324.21	☆ AST/BTC	0.00000227	-10.28%
0.026720	2.007	0.05362704								-25324.21	🟠 ATOM/BTC (50 0.0004356	-9.34%
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0.026707	0.171	0.00456690	P					TAXABLE PARTY	[[]	-0.000000	0.026703	1.923	17:42:09
											0.026704	3.986	17:42:09
0.026692		More III	16:00	2/23	8:00	16:00 2/24	8:00 16:00	2/25 8:0	0 16:00	5	0.026705 0.026704	0.496	17:42:09
0.026702	2.000	0.05340400							-			0.014 2.000	17:42:08 17:42:06
0.0267 01	2.466	0.06584467	Exchang	e Margin					Tra	ding Rules	0.026709	0.768	17:42:08
0.0267 00	26.000	0.69420000	Limite	Market							0.026704	3.761	17:42:04
0.026699	4.000	0.10679600	Limit	Market	Stop-limit 🕜	·					0.026701	0.344	17:42:03
0.026691	0.024	0.00064058									0.026700	2.446	17:42:03

- There was also Mt.Gox and BTC-e
 - You loose control over your funds (Mt. Gox)

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Bitcoin

• This article is more than 5 years old

MtGox files for bankruptcy in Japan after collapse of bitcoin exchange

The bitcoin exchange has debts of £38m and assets of just £22.6m, it reported on Friday



▲ MtGox CEO Mark Karpeles bows in apology at a press conference at the Justice Ministry in Tokyo Friday night, Feb. 28, 2014. Photograph: I/AP

MtGox filed for bankruptcy protection in Tokyo on Friday, with the world's former biggest bitcoin exchange blaming "a weakness in our system" for its collapse.

ARCHIVE Published: January 17, 2019 12:21 PM UTC

Please Do Not Store Crypto on Any Exchange, Warns CEO of Major Crypto Exchange Kraken

Jesse Powell, the CEO of a major crypto exchange Kraken, warned users of digital assets to not store funds on trading platforms. The warning of Powell follows a high profile security breach suffered by Cryptopia, a New Zealand-based crypto exchange known for its listing of...

Author: Joseph Young @iamjosephyoung



Kraken CEO Jesse Powell listens to the people, delists Bitcoin SV | Source: World Government Summit/YouTube

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New York Kraken Ex-Employee Sues Crypto Exchange Over Failure to Pay \$900,000



Why the feds took d

Tracing Mt. Gox's stolen coins led feds to

By Russell Brandom and Sarah Jeong | Jul 29, 2017, 10:00am E

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Illustration by Alex Castro / The Verge

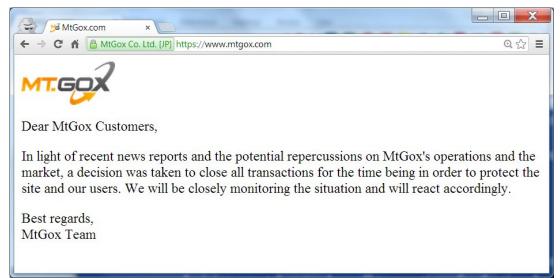
largest exchanges

This week, one of Bitcoin's largest and most notorious coin exchanges was brought down by law enforcement — and police and prosecutors are now beginning to explain why. On Thursday, the Department of Justice unsealed an indictment against Alexander Vinnik — thought to be the operator, or one of the operators of Bitcoin exchange BTC-e — charging

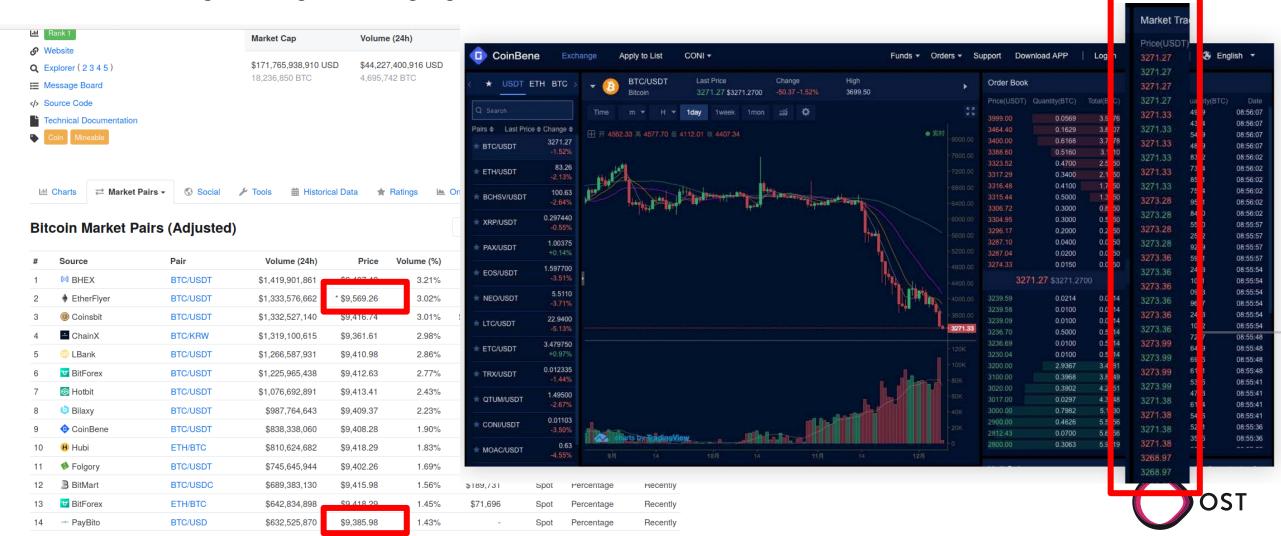
Mt. Gox

- Mt. Gox (short for Magic: The Gathering Online Exchange)
 - July 2010 reused domain name, started Bitcoin trading platform
- April 2013, handled 70% of Bitcoin trades
- November 2013, users reported payout delays
 - Exchange rates different from other trading platforms
- 7. February 2014, suspended all BT withdrawals
 - "Bug in the Bitcoin system": transaction malleability
- 20. February, suspended all withdrawals

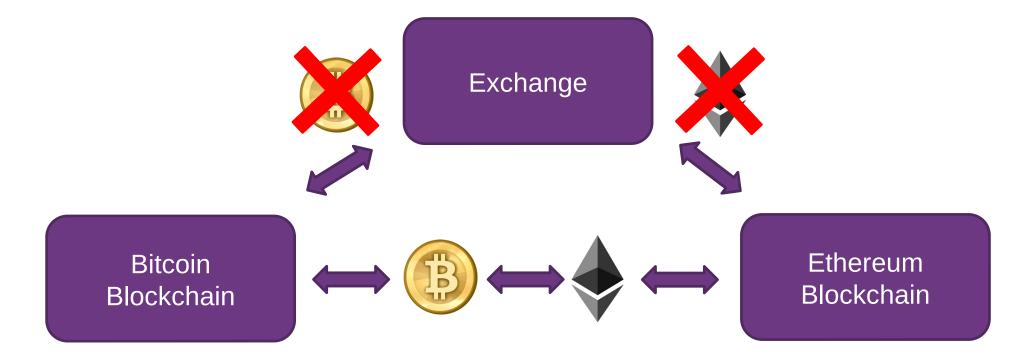
- 24. February, all trading suspended, blank page
- 9. March 2014, filed for bankruptcy
 - 850k Bitcoins missing
- 16.11.2021: Mt. Gox rehabilitation plan is now 'final and binding' [link]
 - Compensate creditors, \$460 million at the time, repaying 150k BTC (from lost 850k BTC)



• Exchanges caught trading against their customers - to boost their numbers



• With Atomic Swaps no trust in a centralized platform is needed





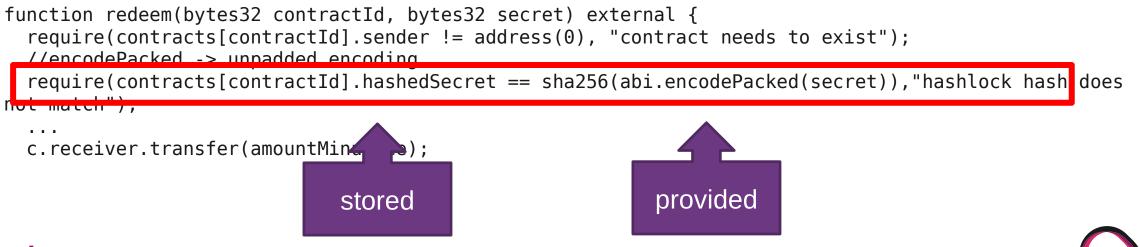
- Building Blocks of Cross-chain Atomic Swaps
- Cryptographic hashing:
 - one-way function computationally efficient in one way, computationally highly expensive the other way
 - deterministic same input same output
 - collision resistant highly expensive to find two inputs that hash to the same output

SHA256 Hash

Data:	aceuaceuac
Hash:	8698bce64d5c921046ce61e7fd0f538ad44c8f5a44e0b7789daf660d653544d8



- Building block for cross-chain atomic swaps and payment channels
- Hash lock:
 - store hashed secret publicly stored in a smart contract
 - unlock only if secret is provided (publicly)



- Building block for cross-chain atomic swaps and payment channels
- Hash time lock:
 - store hashed secret publicly stored in a smart contract
 - unlock only if secret is provided (publicly) before timeout

Or

• unlock – after timeout

function recover(bytes32 contractId) external {

require(contracts[contractId].lockTime <= now, "refundable: timelock not yet passed");</pre>

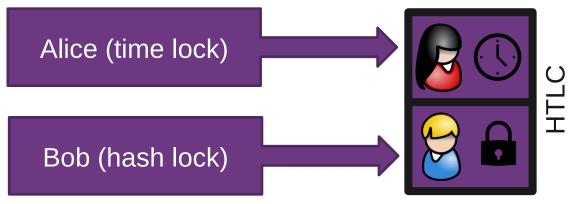
c.sender.transfer(c.amount);

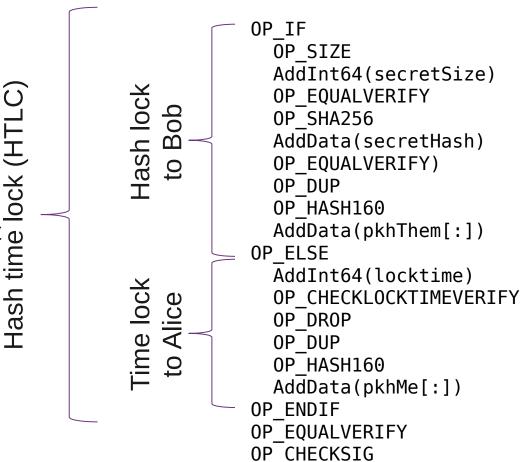


- Building block for cross-chain atomic swaps and payment ch.
- Hash time lock:
 - store hashed secret publicly stored in a smart contract ٠
 - store hashed secret publicly stored in a smart contract unlock only if secret is provided (publicly) before timeout unlock after timeout ٠

Or

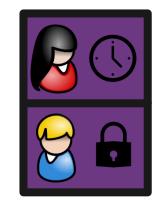
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- Now we are ready to do an atomic swap with Alice and Bob
 - 1 BTC for 37 ETH





Atomic Swaps

- Now we are ready to do an atomic swap with Alice and Bob with HTLC
 - Alice (initiator) creates "secret", shares with Bob, hash(secret)

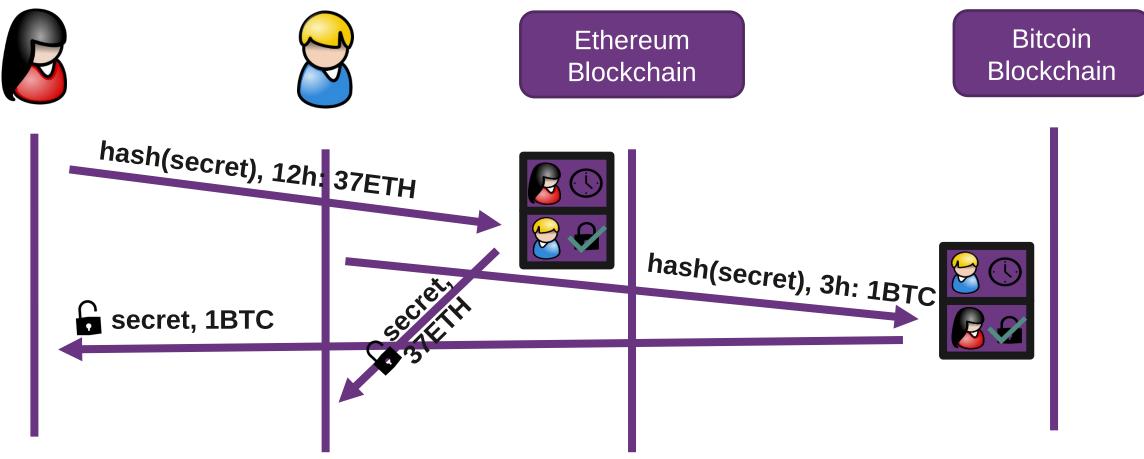


Blockchain BTC

Blockchain ETH



Atomic Swaps - Alice reveals secret to redeem 1 BTC





Atomic Swaps - Bob goes offline (worst case)

