

Bitcoin

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Bitcoin^[note 5] is a payment system invented by Satoshi Nakamoto,^[note 6] who published the invention in 2008^[11] and released it as open-source software in 2009.^[12] The system is peer-to-peer; users can transact directly without needing an intermediary.^{[13]:4} Transactions are verified by network nodes and recorded in a public distributed ledger called the *block chain*.^[14] The ledger uses its own unit of account, also called **bitcoin**.^[note 7] The system works without a central repository or single administrator, which has led the US Treasury to categorize it as a decentralized virtual currency.^[1] Bitcoin is often called the first cryptocurrency,^{[18][19][20]} although prior systems existed.^[note 8] Bitcoin is more correctly described as the first decentralized digital currency.^{[13][23]} It is the largest of its kind in terms of total market value.^[24] Bitcoin is an instrument of alternative finance, which has emerged outside of the traditional financial system^[25].


Bitcoins are created as a reward for payment processing work in which users offer their computing power to verify and record payments into the public ledger. This activity is called mining and the miners are rewarded with transaction fees and newly created bitcoins.^[13] Besides mining, bitcoins can be obtained in exchange for different currencies,^[26] products, and services.^[27] Users can send and receive bitcoins for an optional transaction fee.^[28]

Bitcoin as a form of payment for products and services has grown,^[27] and merchants have an incentive to accept it because fees are lower than the 2–3% typically imposed by credit card processors.^[29] Unlike credit cards, any fees are paid by the purchaser, not the vendor. The European Banking Authority^[30] and other sources^{[13]:11} have warned that bitcoin users are not protected by refund rights or chargebacks. Despite a big increase in the number of merchants accepting bitcoin, the cryptocurrency doesn't have much momentum in retail transactions.^[31]

The use of bitcoin by criminals has attracted the attention of financial regulators,^[32] legislative bodies,^[33] law enforcement,^[34] and media.^[35] Criminal activities are primarily centered around black markets and theft, though officials in countries such as the United States also recognize that bitcoin can provide legitimate financial services.^[36]

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Bitcoin	
	
Logo of the bitcoin reference client	
Administration	Decentralized ^[note 1]
Date of introduction	3 January 2009
User(s)	Worldwide
Supply growth	25 bitcoins per block (approximately every ten minutes) until mid 2016, ^[2] and then afterwards 12.5 bitcoins per block for 4 years until next halving. This halving continues until 2110-2140 when 21 million bitcoins have been issued.
Subunit	
10 ^{−3}	millibitcoin
10 ^{−6}	microbitcoin, bit ^[3]
10 ^{−8}	satoshi ^[4]
Symbol	BTC, ^[note 2] XBT, ^[note 3] ₿ ^[note 4]
millibitcoin	mBTC
microbitcoin, bit ^[3]	µBTC
Coins	unspent outputs of transactions denominated in any multiple of satoshis ^{[9]:ch. 5}

- 5.4 Ponzi scheme
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Design

Block chain

The *block chain* is a public ledger that records bitcoin transactions. A novel solution accomplishes this without any trusted central authority: maintenance of the block chain is performed by a network of communicating nodes running bitcoin software.^[13] Transactions of the form *payer X sends Y bitcoins to payee Z* are broadcast to this network using readily available software applications. Network nodes can validate transactions, add them to their copy of the ledger, and then broadcast these ledger additions to other nodes.^{[9]:ch. 8} The block chain is a distributed database; in order to independently verify the chain of ownership of any and every bitcoin (amount), each network node stores its own copy of the block chain. Approximately six times per hour, a new group of accepted transactions, a block, is created, added to the block chain, and quickly published to all nodes. This allows bitcoin software to determine when a particular bitcoin amount has been spent, which is necessary in order to prevent double-spending in an environment without central oversight. Whereas a conventional ledger records the transfers of actual bills or promissory notes that exist apart from it, the block chain is the only place that bitcoins can be said to exist in the form of unspent outputs of transactions.^{[9]:ch. 5}

Units

The unit of account of the bitcoin system is bitcoin. As of 2014, symbols used to represent bitcoin are BTC,^[note 2] XBT,^[note 3] and ₿.^{[note 4][37]:1} Small amounts of bitcoin used as alternative units are millibitcoin (mBTC), microbitcoin (μBTC), and satoshi. Named in homage to bitcoin's creator, a *satoshi* is the smallest amount within bitcoin representing 0.00000001 bitcoin, one hundred millionth of a bitcoin.^[4] A *millibitcoin* equals to 0.001 bitcoin, which is one thousandth of bitcoin.^[38] One *microbitcoin* equals to 0.000001 bitcoin, which is one millionth of bitcoin. A microbitcoin is sometimes referred to as a *bit*.

On 7 October 2014, the Bitcoin Foundation disseminated a plan to apply for an ISO 4217 currency code for bitcoin,^[5] and mentioned BTC and XBT as the leading candidates.^[39]

Ownership

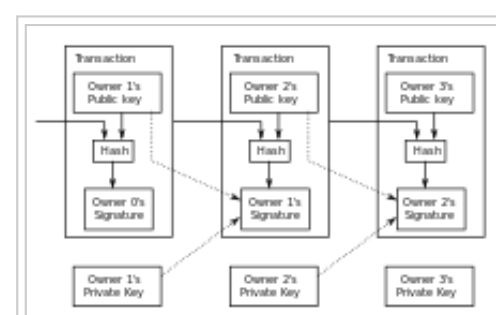
Ownership of bitcoins implies that a user can spend bitcoins associated with a specific address. To do so, a payer must digitally sign the transaction using the corresponding private key. Without knowledge of the private key the transaction cannot be signed and bitcoins cannot be spent. The network verifies the signature using the public key.^{[9]:ch. 5} If the private key is lost, the bitcoin network will not recognize any other evidence of ownership;^[13] the coins are then unusable, and thus effectively lost. For example, in 2013 one user said he lost 7,500 bitcoins, worth \$7.5 million at the time, when he discarded a hard drive containing his private key.^[40]

Transactions

A transaction must have one or more inputs. For the transaction to be valid, every input must be an unspent output of a previous transaction. Every input must be digitally signed. The use of multiple inputs corresponds to the use of multiple coins in a cash transaction. A transaction can also have multiple outputs, allowing one to make multiple payments in one go. A transaction output can be specified as an arbitrary multiple of satoshi. As in a cash transaction, the sum of inputs (coins used to pay) can exceed the intended sum of payments. In such case, an additional output is used, returning the change back to the payer. Any input satoshis not accounted for in the transaction outputs become the transaction fee.^{[9]:ch. 5}

To send money to a bitcoin address, users can click links on webpages; this is accomplished with a provisional bitcoin URI scheme using a template registered with IANA. Bitcoin clients like Electrum and Armory support bitcoin URIs. Mobile clients recognize bitcoin URIs in QR codes, so that the user does not have to type the bitcoin address and amount in manually. The QR code is generated from the user input based on the payment amount. The QR code is displayed on the mobile device screen and can be scanned by a second mobile device.^[41]

Mining



Simplified chain of ownership.^[11] In reality, a transaction can have more than one input and more than one output.

Mining is a record-keeping service.^[note 9] Miners keep the block chain consistent, complete, and unalterable by repeatedly verifying and collecting newly broadcast transactions into a new group of transactions called a *block*. A new block contains information that "chains" it to the previous block thus giving the block chain its name. It is a cryptographic hash of the previous block, using the SHA-256 hashing algorithm.^{[9]:ch. 7}

In order to be accepted by the rest of the network, a new block must contain a so-called *proof-of-work*. The proof-of-work requires miners to find a number called a *nonce*, such that when the block content is hashed along with the nonce, the result is numerically smaller than the network's *difficulty target*.^{[9]:ch. 8} This proof is easy for any node in the network to verify, but extremely time-consuming to generate, as for a secure cryptographic hash miners must try many different nonce values (usually the sequence of tested values is 0, 1, 2, 3, ...^{[9]:ch. 8}) before meeting the difficulty target.

Every 2016 blocks (approximately 14 days), the difficulty target is adjusted based on the network's recent performance, with the aim of keeping the average time between new blocks at ten minutes. In this way the system automatically adapts to the total amount of mining power on the network.^{[9]:ch. 8} For example, between 1 March 2014 and 1 March 2015, the average number of nonces miners had to try before creating a new block increased from 16.4 quintillion to 200.5 quintillion.^[45]

The proof-of-work system, alongside the chaining of blocks, makes modifications of the block chain extremely hard as an attacker must modify all subsequent blocks in order for the modifications of one block to be accepted. As new blocks are mined all the time, the difficulty of modifying a block increases as time passes and the number of subsequent blocks (also called *confirmations* of the given block) increases.^[46]

Practicalities

It has become common for miners to join organized mining pools,^[47] which combine the computational resources of their members in order to increase the frequency of generating new blocks. The reward for each block is then split proportionately among the members, creating a more predictable stream of income for each miner without necessarily changing their long-term average income,^[48] although a fee may be charged for the service.^{[49][50]}

The rewards of mining have led to ever-more-specialized technology being utilized. The most efficient mining hardware makes use of custom designed application-specific integrated circuits, which outperform general purpose CPUs while using less power.^[51] As of 2015, a miner who is not using purpose-built hardware is unlikely to earn enough to cover the cost of the electricity used in their efforts,^[52] even if they are a member of a pool.^[52]

As of 2015, even if all miners used energy efficient processors, the combined electricity consumption would be 1.46 terawatt-hours per year—equal to the consumption of about 135,000 American homes.^[53] In 2013, electricity use was estimated to be 0.36 terawatt-hours per year or the equivalent of powering 31,000 US homes.^[54]

Supply

The successful miner finding the new block is rewarded with newly created bitcoins and transaction fees.^[55] As of 28 November 2012,^[56] the reward amounted to 25 newly created bitcoins per block added to the block chain. To claim the reward, a special transaction called a *coinbase* is included with the processed payments.^{[9]:ch. 8} All bitcoins in circulation can be traced back to such coinbase transactions. The bitcoin protocol specifies that the reward for adding a block will be halved approximately every four years. Eventually, the reward will be removed entirely when an arbitrary limit of 21 million bitcoins is reached c. 2140, and record keeping will then be rewarded by transaction fees solely.^[57]

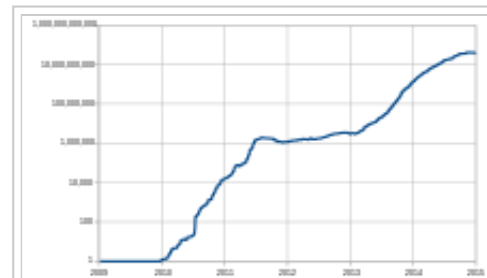
Transaction fees

Paying a transaction fee is optional, but may speed up confirmation of the transaction.^[58] Payers have an incentive to include such fees because doing so means their transaction is more likely to be added to the block chain sooner; miners can choose which transactions to process^[28] and prioritize those that pay higher fees. Fees are based on the storage size of the transaction generated, which in turn is dependent on the number of inputs used to create the transaction. Furthermore, priority is given to older unspent inputs.^[59]

Wallets

A *wallet* stores the information necessary to transact bitcoins. While wallets are often described as a place to hold^[60] or store bitcoins,^[61] due to the nature of the system, bitcoins are inseparable from the block chain transaction ledger. Perhaps a better way to describe a wallet is something that "stores the digital credentials for your bitcoin holdings"^[61] and allows you to access (and spend) them. Bitcoin uses public-key cryptography, in which two cryptographic keys, one public and one private, are generated.^[62] At its most basic, a wallet is a collection of these keys.

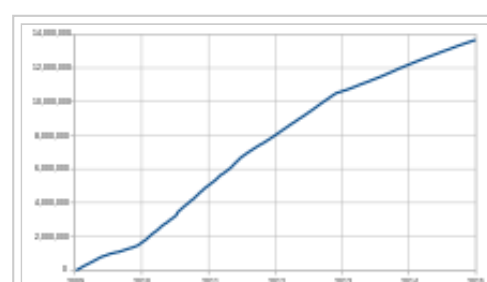
There are several types of wallet. *Software wallets* connect to the network and allow spending bitcoins in addition to holding the credentials that prove ownership.^[63] Internet services called *online wallets* like Blockchain.info, Circle, or Coinbase offer similar functionality but may be easier to use; in essence, bitcoin credentials are stored with the online wallet



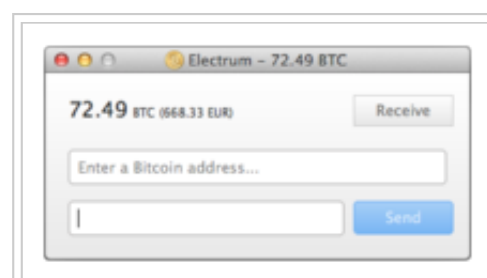
Relative mining difficulty from 9 January 2009 to 31 December 2014 (the difficulty scale is logarithmic).^[42] Relative mining difficulty is defined as the ratio between the difficulty target on 9 January 2009 and the current difficulty target.



ASICMiner Block Erupter, a type of mining hardware used in 2013.^[43]



Total bitcoins in circulation.^[42] Horizontal axis: date ranging from 9 January 2009 to 31 December 2014.



Electrum bitcoin wallet

provider rather than on the user's hardware.^{[64][65]} *Physical wallets* also exist and are more secure, as they store the credentials necessary to spend bitcoins offline.^[61] Examples combine a novelty coin with these credentials printed on metal,^[66] wood, or plastic. Others are simply paper printouts. Another type of wallet called a *hardware wallet* keeps credentials offline while facilitating transactions.^[67]

Reference implementation

The first wallet program was released in 2009 by Satoshi Nakamoto as open-source code and was originally called *bitcoind*.^[68] Sometimes referred to as the "Satoshi client," this is also known as the reference client because it serves to define the bitcoin protocol and acts as a standard for other implementations.^[63] In version 0.5 the client moved from the wxWidgets user interface toolkit to Qt, and the whole bundle was referred to as Bitcoin-Qt.^[63] After the release of version 0.9, Bitcoin-Qt was renamed Bitcoin Core.^[69]



Bitcoin paper wallet generated at bitaddress.org

Privacy

Privacy is achieved by not identifying owners of bitcoin addresses while making other transaction data public. Bitcoin users are not identified by name, but transactions can be linked to individuals and companies.^[70] Additionally, bitcoin exchanges, where people buy and sell bitcoins for fiat money, may be required by law to collect personal information.^[71] To maintain financial privacy, a different bitcoin address for each transaction is recommended.^[72] Transactions that spend coins from multiple inputs can reveal that the inputs may have a common owner. Users concerned about privacy can use so-called mixing services that swap coins they own for coins with different transaction histories.^[73] It has been suggested that bitcoin payments should not be considered more private than credit card payments.^[74]



Trezor hardware wallet

Fungibility

Wallets and similar software technically handle bitcoins as equivalent, establishing the basic level of fungibility. Researchers have pointed out that the history of every single bitcoin is registered and publicly available in the block chain ledger, and that some users may refuse to accept bitcoins coming from controversial transactions, which would harm bitcoin's fungibility.^[75] Projects such as Zerocoin and Dark Wallet aim to address these privacy and fungibility issues.^{[76][77]}

History

Bitcoin was invented by Satoshi Nakamoto,^[note 6] who published the invention on 31 October 2008 in a research paper called "Bitcoin: A Peer-to-Peer Electronic Cash system".^[11] It was implemented as open source code and released in January 2009. Bitcoin is often called the first cryptocurrency^{[18][19][20]} although prior systems existed.^[note 8] Bitcoin is more correctly described as the first decentralized digital currency.^{[13][23]}

One of the first supporters, adopters, contributor to bitcoin and receiver of the first bitcoin transaction was programmer Hal Finney. Finney downloaded the bitcoin software the day it was released, and received 10 bitcoins from Nakamoto in the world's first bitcoin transaction.^{[78][79]}

Other early supporters were Wei Dai, creator of bitcoin predecessor *b-money*, and Nick Szabo, creator of bitcoin predecessor *bit gold*.^[80]

In 2010, an exploit in an early bitcoin client was found that allowed large numbers of bitcoins to be created.^[81] The artificially created bitcoins were removed when another chain overtook the bad chain.^[82]

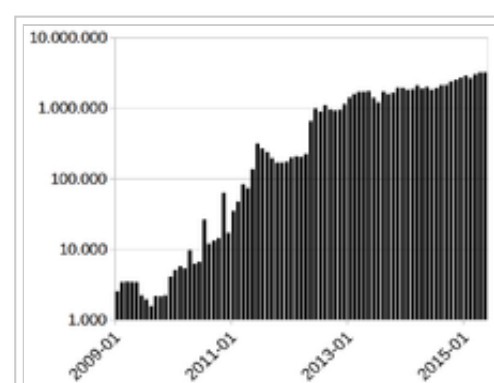
Based on bitcoin's open source code, other cryptocurrencies started to emerge in 2011.^[24]

In March 2013, a technical glitch caused a fork in the block chain, with one half of the network adding blocks to one version of the chain and the other half adding to another. For six hours two bitcoin networks operated at the same time, each with its own version of the transaction history. The core developers called for a temporary halt to transactions, sparking a sharp sell-off.^[83] Normal operation was restored when the majority of the network downgraded to version 0.7 of the bitcoin software.^[83]

In 2013 some mainstream websites began accepting bitcoins. WordPress had started in November 2012,^[84] followed by OKCupid in April 2013,^[85] Atomic Mall in November 2013,^[86] TigerDirect^[87] and Overstock.com in January 2014,^[88] Expedia in June 2014,^[89] Newegg and Dell in July 2014,^[90] and Microsoft in December 2014.^{[91][note 10]} Certain non-profit or advocacy groups such as the Electronic Frontier Foundation accept bitcoin donations.^[93] (The organization started accepting bitcoins in January 2011,^[94] stopped accepting them in June 2011,^[95] and began again in May 2013.^[93])

In May 2013, the Department of Homeland Security seized assets belonging to the Mt. Gox exchange.^[96] The U.S. Federal Bureau of Investigation (FBI) shut down the Silk Road website in October 2013.^[97]

In October 2013, Chinese internet giant Baidu had allowed clients of website security services to pay with bitcoins.^[98] During November 2013, the China-based bitcoin exchange BTC China overtook the Japan-based Mt. Gox and the Europe-based Bitstamp to become the largest bitcoin trading exchange by trade volume.^[99] On 19 November 2013, the value of a bitcoin on the Mt. Gox exchange soared to a peak of US\$900 after a United



Number of bitcoin transactions per month (logarithmic scale).

States Senate committee hearing was told by the FBI that virtual currencies are a legitimate financial service.^[100] On the same day, one bitcoin traded for over RMB¥6780 (US\$1,100) in China.^[101] On 5 December 2013, the People's Bank of China prohibited Chinese financial institutions from using bitcoins.^[102] After the announcement, the value of bitcoins dropped,^[103] and Baidu no longer accepted bitcoins for certain services.^[104] Buying real-world goods with any virtual currency has been illegal in China since at least 2009.^[105]

The first bitcoin ATM was installed in October 2013 in Vancouver, British Columbia, Canada.^[106]

With about 12 million existing bitcoins in November 2013,^[107] the new price increased the market cap for bitcoin to at least US\$7.2 billion.^[108] By 23 November 2013, the total market capitalization of bitcoin exceeded US\$10 billion for the first time.^[109]

In the US two men were arrested in January 2014 on charges of money-laundering using bitcoins; one was Charlie Shrem, the head of now defunct bitcoin exchange BitInstant and a vice chairman of the Bitcoin Foundation. Shrem allegedly allowed the other arrested party to purchase large quantities of bitcoins for use on black-market websites.^[110]

In early February 2014, one of the largest bitcoin exchanges, Mt. Gox,^[111] suspended withdrawals citing technical issues.^[112] By the end of the month, Mt. Gox had filed for bankruptcy protection in Japan amid reports that 744,000 bitcoins had been stolen.^[113] Originally a site for trading Magic: The Gathering cards,^[114] Mt. Gox had once been the dominant bitcoin exchange but its popularity had waned as users experienced difficulties withdrawing funds.^[115]

On June 18, 2014, it was announced that bitcoin payment service provider BitPay would become the new sponsor of St. Petersburg Bowl under a two-year deal, renamed the Bitcoin St. Petersburg Bowl. Bitcoin was to be accepted for ticket and concession sales at the game as part of the sponsorship, and the sponsorship itself was also paid for using bitcoin.^[116]

Less than one year after the collapse of Mt. Gox, Bitstamp announced that the exchange would be taken offline while they investigate a hack which resulted in about 19,000 bitcoins (equivalent to roughly US\$5 million at that time) being stolen from their hot wallet.^[117] The exchange remained offline for several days amid speculation that customers had lost their funds. Bitstamp resumed trading on January 9 after increasing security measures and assuring customers that their account balances would not be impacted.^[118]

The bitcoin exchange service Coinbase launched the first regulated bitcoin exchange in 25 US states on January 26, 2015. At the time of the announcement, CEO Brian Armstrong stated that Coinbase intends to expand to thirty countries by the end of 2015.^[119] A spokesperson for Benjamin M. Lawsky, the superintendent of New York state's Department of Financial Services, stated that Coinbase is operating without a license in the state of New York. Lawsky is responsible for the development of the so-called 'BitLicense', which companies need to acquire in order to legally operate in New York.^[120]

Economics

Classification

According to the director of the Institute for Money, Technology and Financial Inclusion at the University of California-Irvine there is "an unsettled debate about whether bitcoin is a currency".^[121] Bitcoin is commonly referred to with terms like: digital currency,^{[13]:1} digital cash,^[122] virtual currency,^[4] electronic currency,^[15] or cryptocurrency.^[121] Its inventor, Satoshi Nakamoto, used the term electronic cash.^[11] Bitcoins have three useful qualities in a currency, according to the *Economist* in January 2015: they are "hard to earn, limited in supply and easy to verify".^[123]

Economists define money as a store of value, a medium of exchange, and a unit of account and agree that bitcoin has some way to go to meet all these criteria.^[124] It does best as a medium of exchange.^[note 11] The bitcoin market currently suffers from volatility, limiting the ability of bitcoin to act as a stable store of value, and retailers accepting bitcoin use other currencies as their principal unit of account.^[124]

Journalists and academics also dispute what to call bitcoin. Some media outlets do make a distinction between "real" money and bitcoins,^[126] while others call bitcoin real money.^[127] The Wall Street Journal declared it a commodity in December 2013.^[128] A *Forbes* journalist referred to it as digital collectible.^[129] Two University of Amsterdam computer scientists proposed the term "money-like informational commodity".^[130]

The People's Bank of China has stated that bitcoin "is fundamentally not a currency but an investment target".^[131]

Buying and selling

Bitcoins can be bought and sold both on- and offline. Participants in online exchanges offer bitcoin buy and sell bids. Using an online exchange to obtain bitcoins entails some risk, and, according to a study published in April 2013, 45% of exchanges fail and take client bitcoins with them.^[132] Exchanges have since implemented measures to provide proof of reserves in an effort to convey transparency to users.^[133] Offline, bitcoins may be purchased directly from an individual^[134] or at a bitcoin ATM.^[135]

Price and volatility

To improve access to price information and increase transparency, on 30 April 2014 Bloomberg LP announced plans to list prices from bitcoin companies Kraken and Coinbase on its 320,000 subscription financial data terminals.^{[136][137]}

According to Mark T. Williams, as of 2014, bitcoin has volatility seven times greater than gold, eight times greater than the S&P 500, and eighteen times greater than the U.S. dollar.^[138]

Attempting to explain the high volatility, a group of Japanese scholars stated that there is no stabilization mechanism.^[139] The Bitcoin Foundation contends that high volatility is due to insufficient liquidity,^[140] while a *Forbes* journalist claims that it is related to the uncertainty of its long-term value,^[141] and the high volatility of a startup currency makes sense, "because people are still experimenting with the currency to figure out how useful it is."^[142]

There are uses where volatility does not matter, such as online gambling, tipping, and international remittances.^[142] As of 2014, pro-bitcoin venture capitalists argued that the greatly increased trading volume that planned high-frequency trading exchanges would generate is needed to decrease price volatility.^[136]

The price of bitcoins has gone through various cycles of appreciation and depreciation referred to by some as bubbles and busts.^{[143][144]} In 2011, the value of one bitcoin rapidly rose from about US\$0.30 to US\$32 before returning to US\$2.^[145] In the latter half of 2012 and during the 2012-2013 Cypriot Financial Crisis, the bitcoin price began to rise,^[146] reaching a high of US\$266 on 10 April 2013, before crashing to around US\$50.^[147] On November 29, 2013, the cost of one bitcoin rose to the all-time peak of US\$1,242.^[148] In 2014, the price fell sharply, and as of April remained depressed at little more than half 2013 prices. As of August 2014 it was under US\$600.^[149] In January 2015, noting that the bitcoin price had dropped to its lowest level since spring 2013 - around US\$224 - *The New York Times* suggested that "[w]ith no signs of a rally in the offing, the industry is bracing for the effects of a prolonged decline in prices. In particular, bitcoin mining companies, which are essential to the currency's underlying technology, are flashing warning signs."^[150] Also in January 2015, *Business Insider* reported that deep web drug dealers were "freaking out" as they lost profits through being unable to convert bitcoin revenue to cash quickly enough as the price declined - and that there was a danger that dealers selling reserves to stay in business might force the bitcoin price down further.^[151]



Price^[note 12] and volatility^[note 13] chart.^[42] Left vertical axis: price, the scale is logarithmic. Right vertical axis: volatility. Horizontal axis: date ranging from 17 August 2010 to 31 December 2014.

Speculative bubble dispute

Bitcoin has been labelled a *speculative bubble* by many including former Fed Chairman Alan Greenspan^[152] and economist John Quiggin.^[153] Nobel laureate Robert Shiller said that bitcoin "exhibited many of the characteristics of a speculative bubble".^[154] Two lead software developers of bitcoin, Gavin Andresen^[155] and Mike Hearn,^[156] have warned that bubbles may occur. David Andolfatto, a vice president at the Federal Reserve Bank of St. Louis, stated, "Is bitcoin a bubble? Yes, if bubble is defined as a liquidity premium." According to Andolfatto, the price of bitcoin "consists purely of a bubble," but he concedes that many assets have prices that are greater than their intrinsic value.^{[44]:21} Journalist Matthew Boesler rejects the speculative bubble label and sees bitcoin's quick rise in price as nothing more than normal economic forces at work.^[157] The *Washington Post* pointed out that the observed cycles of appreciation and depreciation don't correspond to the definition of speculative bubble.^[145]

Ponzi scheme dispute

Various journalists,^[158] U.S. economist Nouriel Roubini,^[159] and the head of the Estonian central bank^[160] have voiced concerns that bitcoin may be a Ponzi scheme. A 2012 report by the European Central Bank stated, "it [is not] easy to assess whether or not the bitcoin system actually works like a pyramid or Ponzi scheme."^{[161]:27} A 2014 report by the World Bank concluded that "contrary to a widely-held opinion, bitcoin is not a deliberate Ponzi".^{[162]:7} In the opinion of Eric Posner, a law professor at the University of Chicago, "A real Ponzi scheme takes fraud; bitcoin, by contrast, seems more like a collective delusion."^[158]

U.S. economist Nouriel Roubini, a former senior adviser to the U.S. Treasury and the International Monetary Fund, has stated that bitcoin is "a Ponzi game".^[163] In February 2014, an asset manager and columnist for *The New York Post* called bitcoin a Ponzi scheme, opining, "Welcome to 21st-century Ponzi scheme: Bitcoin".^[164] The head of the Estonian central bank, Mihkel Nommela, stated, "virtual currency schemes are an innovation that deserves some caution, given the lack of ... evidence that this isn't just a Ponzi scheme."^[160]

Others have expressed the opinion that bitcoin is not a Ponzi scheme. *The Huffington Post* asked, "is bitcoin a Ponzi scheme, yes or no?" and answered itself with a definitive "no!"^[165] *PC World* magazine stated, "bitcoin is clearly not a Ponzi scheme".^[166] Economist Jeffrey Tucker claims that "there are several key differences between a Ponzi scheme and bitcoin."^[167] A 2014 report by the Swiss Federal Council states, "the question is repeatedly raised whether bitcoin can be deemed an impermissible pyramid scheme... since in the case of bitcoin the typical promises of profits are lacking, it cannot be assumed that bitcoin is a pyramid scheme."^{[168]:21}

Value forecasts

Financial journalists and analysts, economists, and investors have attempted to predict the possible future value of bitcoin. In April 2013, economist John Quiggin stated, "bitcoins will attain their true value of zero sooner or later, but it is impossible to say when".^[153] A similar forecast was made in November 2014 by economist Kevin Dowd.^[169] In November 2014, David Yermack, Professor of Finance at New York University Stern School of Business, forecast that in November 2015 bitcoin may be all but worthless.^[170] In December 2013, finance professor Mark T. Williams forecast a bitcoin would be worth less than \$10 by July 2014.^[171] In the indicated period bitcoin has exchanged as low as \$344 (April 2014) and during July 2014 the bitcoin low was \$609.^{[42][172]} In December 2014, Professor Williams said, "The probability of success is low, but if it does hit, the reward will be very large."^[173] In May 2013, Bank of America FX and Rate Strategist David Woo forecast a maximum fair value per bitcoin of \$1,300.^[174] Bitcoin investor Cameron Winklevoss stated in December 2013 that the "small bull case scenario for bitcoin is... 40,000 USD a coin".^[175]

Bitcoin obituaries

The "death" of bitcoin has been proclaimed numerous times.^[176] One journalist has recorded 29 such "obituaries" as of early 2015.^[176] *Forbes* declared bitcoin dead in June 2011,^[177] followed by *Gizmodo Australia* in August 2011.^[178] *Wired* wrote it had expired in December 2012,^[179] *Ouishare Magazine* declared, "game over, bitcoin" in May 2013,^[180] and *New York Magazine* stated bitcoin was on its path to grave in June 2013.^[181] *Reuters* published an "obituary" for bitcoin in January 2014^[182] *Street Insider* declared bitcoin dead in February 2014,^[183] as did *The Weekly Standard* in March 2014,^[184] followed by *Salon* in March 2014,^[185] and *Vice News* in March 2014,^[186] then the *Financial Times* in September 2014.^[187] In January 2015, *USA Today* states bitcoin was "headed to the ash heap",^[188] and *The Telegraph* declared "the end of bitcoin experiment".^[189] Peter Greenhill, Director of E-Business Development for the Isle of Man, commenting on the obituaries paraphrased Mark Twain saying "reports of bitcoin's death have been greatly exaggerated".^[190]

Reception

Some economists have responded positively to bitcoin, but many have not. François R. Velde, Senior Economist at the Chicago Fed described it as "an elegant solution to the problem of creating a digital currency".^[191] According to *Wired* "in the estimation of many leading economists, bitcoin is a fatally flawed idea shaped by people who don't really understand how money works".^[192] Paul Krugman and Brad DeLong have found fault with bitcoin questioning why it should act as a reasonably stable store of value or whether there is a floor on its value.^[193] Economist John Quiggin has criticized bitcoin as "the final refutation of the efficient-market hypothesis".^[153]

David Andolfatto, Vice President at the Federal Reserve Bank of St. Louis, stated that bitcoin is a threat to the establishment, which he argues is a good thing for the Federal Reserve System and other central banks because it prompts these institutions to operate sound policies.^{[44]:33[194][195]}

Free software movement activist Richard Stallman has criticized the lack of anonymity and called for reformed development.^[196] PayPal President David A. Marcus calls bitcoin a "great place to put assets" but claims it will not be a currency until price volatility is reduced.^[197] Bill Gates, in relation to the cost of moving money from place to place in an interview for Bloomberg L.P. stated: "Bitcoin is exciting because it shows how cheap it can be."^[198]

Similarly, Peter Schiff, a bitcoin sceptic understands "the value of the technology as a payment platform" and his Euro Pacific Precious Metals fund partnered with BitPay in May 2014, because "a wire transfer of fiat funds can be slow and expensive for the customer".^[199]

Kevin Dowd, Professor of Finance and economics at Durham University has a bearish outlook on bitcoin. His presentation at the Cato Institute 2014 Annual Conference, Alternatives to Central Banking: Toward Free-Market Money, touched on bitcoin.^[200]

Acceptance by merchants

In 2015, the number of merchants accepting bitcoin exceeded 100,000.^[125] As of December 2014 established firms that accept payments in bitcoin include Atomic Mall,^[86] Clearly Canadian,^[201] Dell,^[202] Dish Network,^[203] Dynamite Entertainment,^[204] Expedia,^[205] Microsoft,^[91] Newegg,^[206] PrivateFly,^[207] Overstock.com,^[88] the Sacramento Kings,^[208] TigerDirect,^[87] Time Inc.,^[209] Virgin Galactic,^[210] and Zynga.^{[211][note 10]} Due to the fact that chargebacks are impossible, retailers usually offer in-store credit as the only option when returning items purchased with bitcoins.^[212] As of September 2014 PayPal allows North American merchants using its system the ability to receive payment in bitcoins.^[213]



Bitcoins are accepted in this café in the Netherlands as of 2013

Acceptance by nonprofits

Organizations accepting donations in bitcoin include: Greenpeace,^[214] The Mozilla Foundation,^[215] and The Wikimedia Foundation.^[216] Some U.S. political candidates, including New York City Democratic Congressional candidate Jeff Kurzon have said they would accept campaign donations in bitcoin.^[217] In late 2013 the University of Nicosia became the first university in the world to accept bitcoins.^[218]

Use in retail transactions

Due to the design of bitcoin, all retail figures are only estimates.^{[31][219]} According to Tim Swanson, head of business development at a Hong Kong-based cryptocurrency technology company, in 2014, daily retail purchases made with bitcoin were worth about \$2.3 million.^[219] He estimates that, as of February 2015, fewer than 5,000 bitcoins per day (worth roughly \$1.2 million at the time) were being used for retail transactions,^[31] and concluded that in 2014 "it appears there has been very little if any increase in retail purchases using bitcoin."^[31]

Financial institutions

Bitcoin companies have had difficulty opening traditional bank accounts because lenders have been leery of bitcoin's links to illicit activity.^[220] According to Antonio Gallippi, a co-founder of BitPay, "banks are scared to deal with bitcoin companies, even if they really want to".^[221] In 2014, the National Australia Bank closed accounts of businesses with ties to bitcoin,^[222] and HSBC refused to serve a hedge fund with links to bitcoin.^[223]

One financial institution has been bullish on bitcoin. In a 2013 report, Bank of America Merrill Lynch stated that "we believe bitcoin can become a major means of payment for e-commerce and may emerge as a serious competitor to traditional money-transfer providers."^[224] In June 2014, the first bank that converts deposits in currencies instantly to bitcoin without any fees was opened in Boston.^[225]

As an investment

Some Argentinians have bought bitcoins to protect their savings against high inflation or the possibility that governments could confiscate savings accounts.^[71] During the 2012–2013 Cypriot financial crisis, bitcoin purchases in Cyprus rose due to fears that savings accounts would be confiscated or taxed.^[226] Other methods of investment are bitcoin funds. The first regulated bitcoin fund was established in Jersey in July 2014 and approved by the Jersey Financial Services Commission.^[227] Also, c. 2012 an attempt was made by the Winklevoss twins (who in April 2013 claimed they owned nearly 1% of all bitcoins in existence^[228]) to establish a bitcoin ETF.^[229] As of early 2015, they have announced plans to launch a New York-based bitcoin exchange named Gemini.^[230]

In 2013 and 2014, the European Banking Authority^[30] and the Financial Industry Regulatory Authority (FINRA), a United States self-regulatory organization,^[231] warned that investing in bitcoins carries significant risks. Such risks were highlighted in 2014 when Bloomberg named bitcoin as one of its worst investments of the year,^[232] although Forbes named bitcoin the best investment of 2013.^[233] Bloomberg selected the Russian ruble as the worst currency investment of 2014 but also mentioned bitcoin as the "one currency that did worse [than the ruble] in 2014, depending on whether you think virtual currencies are real money."^[232]

In May 2015, Intercontinental Exchange Inc., parent company of the New York Stock Exchange, announced a bitcoin index initially based on data from Coinbase transactions.^[234]

Venture capital

Venture capitalists, such as Peter Thiel's Founders Fund, which invested US\$3 million in BitPay, do not purchase bitcoins themselves, instead funding bitcoin infrastructure like companies that provide payment systems to merchants, exchanges, wallet services, etc.^[235] In 2012, an incubator for bitcoin-focused start-ups was founded by Adam Draper, with financing help from his father, venture capitalist Tim Draper, one of the largest bitcoin holders after winning an auction of 30,000 bitcoins,^[236] at the time called 'mystery buyer'.^[237] The company's goal is to fund 100 bitcoin businesses within 2–3 years with \$10,000 to \$20,000 for a 6% stake.^[236] Investors also invest in bitcoin mining.^[238]

Political economy

Bitcoin appeals to tech-savvy libertarians, because it so far exists outside the institutional banking system and the control of governments.^[239] However, researchers looking to uncover the reasons for interest in bitcoin did not find evidence that this was linked to libertarianism.^[240]

Bitcoin's appeal reaches from left wing critics, "who perceive the state and banking sector as representing the same elite interests, [...] recognising in it the potential for collective direct democratic governance of currency"^[241] and socialists proposing their "own states, complete with currencies",^[242] to right wing critics suspicious of big government, at a time when activities within the regulated banking system were responsible for the severity of the financial crisis of 2007–08,^[243] "because governments are not fully living up to the responsibility that comes with state-sponsored money".^[244] Bitcoin has been described as "remov[ing] the imbalance between the big boys of finance and the disenfranchised little man, potentially allowing early adopters to negotiate favourable rates on exchanges and transfers – something that only the very biggest firms have traditionally enjoyed".^[245] Two WSJ journalists describe bitcoin in their book as "about freeing people from the tyranny of centralised trust".^[246]

Legal status and regulation

The legal status of bitcoin varies substantially from country to country and is still undefined or changing in many of them. While some countries have explicitly allowed its use and trade, others have banned or severely restricted it. Likewise, various government agencies, departments, and courts have classified bitcoins differently. Regulations and bans that apply to bitcoin probably extend to similar cryptocurrency systems.

In April 2013, Steven Strauss, a Harvard public policy professor, suggested that governments could outlaw bitcoin,^[247] and this possibility was mentioned again by a bitcoin investment vehicle in a July 2013, report to a regulator.^[229] However, the vast majority of nations have not done so as of 2014. It is illegal in: Bangladesh,^[248] Bolivia,^[249] Ecuador,^[250] Russia,^[251] and Vietnam.^[252]

Criminal activity

The use of bitcoin by criminals has attracted the attention of financial regulators, legislative bodies, law enforcement, and the media.^[32] The FBI prepared an intelligence assessment,^[34] the SEC has issued a pointed warning about investment schemes using virtual currencies,^[32] and the U.S. Senate held a hearing on virtual currencies in November 2013. CNN has referred to bitcoin as a "shady online currency [that is] starting to gain legitimacy in certain parts of the world",^[253] and The Washington Post called it "the currency of choice for seedy online activities".^[35]

Several news outlets have asserted that the popularity of bitcoins hinges on the ability to use them to purchase illegal goods.^{[254][255]} In 2014, researchers at the University of Kentucky found "robust evidence that computer programming enthusiasts and illegal activity drive interest in bitcoin, and find limited or no support for political and investment motives."^[240]

Theft

There have been many cases of bitcoin theft.^[62] One way this is accomplished involves a third party accessing the private key to a victim's bitcoin address,^[256] or of an online wallet.^[257] If the private key is stolen, all the bitcoins from the compromised address can be transferred. In that case, the network does not have any provisions to identify the thief, block further transactions of those stolen bitcoins, or return them to the legitimate owner.^[229]

Theft also occurs at sites bitcoins are used to purchase illicit goods. In late November 2013, an estimated \$100 million in bitcoins were allegedly stolen from the online illicit goods marketplace Sheep Marketplace, which immediately closed.^[258] Users tracked the coins as they were processed and converted to cash, but no funds were recovered and no culprits identified.^[258] A different black market, Silk Road 2, stated that during a February 2014

hack, bitcoins valued at \$2.7 million were taken from escrow accounts.^[259]

Sites where users exchange bitcoins for cash or store them in "wallets" are also targets for theft. Inputs.io, an Australian wallet service, was hacked twice in October 2013 and lost more than \$1 million in bitcoins.^[260] In late February 2014 Mt. Gox, one of the largest virtual currency exchanges, filed for bankruptcy in Tokyo amid reports that bitcoins worth \$350 million had been stolen.^[113] Flexcoin, a bitcoin storage specialist based in Alberta, Canada, shut down on March 2014 after saying it discovered a theft of about \$650,000 in bitcoins.^[261] Poloniex, a digital currency exchange, reported on March 2014 that it lost bitcoins valued at around \$50,000.^[262] In January 2015 UK based bitstamp, the third busiest bitcoin exchange globally, was hacked and \$5 million in bitcoins were stolen.^[263] February 2015 saw a Chinese exchange named BTER lose bitcoins worth nearly \$2 million to hackers.^[264]

Black markets

A CMU researcher estimated that in 2012, 4.5% to 9% of all transactions on all exchanges in the world were for drug trades on a single deep web drugs market, Silk Road.^[265] Child pornography,^[266] murder-for-hire services,^[267] and weapons^[268] are also available on black market sites that sell in bitcoin.

Several deep web black markets have been shut by authorities. In October 2013 Silk Road was shut down by U.S. law enforcement^{[269][270][271]} leading to a short-term decrease in the value of bitcoin.^[272] In 2015, the founder of the site was sentenced to life in prison.^[273] Alternative sites were soon available, and in early 2014 the Australian Broadcasting Corporation reported that the closure of Silk Road had little impact on the number of Australians selling drugs online, which had actually increased.^[274] In early 2014, Dutch authorities closed Utopia, an online illegal goods market, and seized 900 bitcoins.^[275] In late 2014, a joint police operation saw European and American authorities seize bitcoins and close 400 deep web sites including the illicit goods market Silk Road 2.0.^[276] Law enforcement activity has resulted in several convictions. In December, 2014, Charlie Shrem was sentenced to two years in prison for indirectly helping to send \$1 million to the Silk Road drugs site,^[277] and in February, 2015, its founder, Ross Ulbricht, was convicted on drugs charges and faces a life sentence.^[278]

Some black market sites may seek to steal bitcoins from customers. The bitcoin community branded one site, Sheep Marketplace, as a scam when it prevented withdrawals and shut down after an alleged bitcoins theft.^[279] In a separate case, escrow accounts with bitcoins belonging to patrons of a different black market were hacked in early 2014.^[259]

According to the Internet Watch Foundation, a U.K. based charity, bitcoin is used to purchase child pornography, and almost 200 such websites accept it as payment. Bitcoin isn't the sole way to purchase child pornography online, as Troels Oertling, head of the cybercrime unit at Europol, states, "Ukash and Paysafecard... have [also] been used to pay for such material." However, the Internet Watch Foundation lists around 30 sites that exclusively accept bitcoins.^[266] Some of these sites have shut down, such as a deep web crowdfunding website that aimed to fund the creation of new child porn.^[280] Furthermore, hyperlinks to child porn websites have been added to the block chain as arbitrary data can be included when a transaction is made.^{[281][282]}

Money laundering

Bitcoins may not be ideal for money laundering because all transactions are public.^[283] Authorities, including the European Banking Authority^[30] the FBI,^[34] and the Financial Action Task Force of the G7^[284] have expressed concerns that bitcoin may be used for money laundering. In early 2014, an operator of a U.S. bitcoin exchange was arrested for money laundering.^[110]

Ponzi scheme

In a Ponzi scheme that utilized bitcoins, The Bitcoin Savings and Trust promised investors up to 7 percent weekly interest, and raised at least 700,000 bitcoins from 2011 to 2012.^[285] In July 2013 the U.S. Securities and Exchange Commission charged the company and its founder in 2013 "with defrauding investors in a Ponzi scheme involving bitcoin".^[285] In September 2014 the judge fined Bitcoin Savings & Trust and its owner \$40 million for operating a bitcoin Ponzi scheme.^[286]

Malware

Bitcoin-related malware includes software that steals bitcoins from users using a variety of techniques, software that uses infected computers to mine bitcoins, and different types of ransomware, which disable computers or prevent files from being accessed until some payment is made. Security company Dell SecureWorks said in February 2014 that it had identified almost 150 types of bitcoin malware.^[287]

Unauthorized mining

In June 2011, Symantec warned about the possibility that botnets could mine covertly for bitcoins.^[288] Malware used the parallel processing capabilities of GPUs built into many modern video cards.^[289] Although the average PC with an integrated graphics processor is virtually useless for bitcoin mining, tens of thousands of PCs laden with mining malware could produce some results.^[290]

In mid-August 2011, bitcoin mining botnets were detected,^[291] and less than three months later, bitcoin mining trojans had infected Mac OS X.^[292]

In April 2013, electronic sports organization E-Sports Entertainment was accused of hijacking 14,000 computers to mine bitcoins; the company later settled the case with the State of New Jersey.^[293]

German police arrested two people in December 2013 who customized existing botnet software to perform bitcoin mining, which police said had been used to mine at least \$950,000 worth of bitcoins.^[294]

For four days in December 2013 and January 2014, Yahoo! Europe hosted an ad containing bitcoin mining malware that infected an estimated two million computers.^[290] The software, called Sefnit, was first detected in mid-2013 and has been bundled with many software packages. Microsoft has been removing the malware through its Microsoft Security Essentials and other security software.^[295]

Several reports of employees or students using university or research computers to mine bitcoins have been published.^[296]

Malware stealing

Some malware can steal private keys for bitcoin wallets allowing the bitcoins themselves to be stolen. The most common type searches computers for cryptocurrency wallets to upload to a remote server where they can be cracked and their coins stolen.^[297] Many of these also log keystrokes to record passwords, often avoiding the need to crack the keys.^[297] A different approach detects when a bitcoin address is copied to a clipboard and quickly replaces it with a different address, tricking people into sending bitcoins to the wrong address.^[298] This method is effective because bitcoin transactions are irreversible.

One virus, spread through the Pony botnet, was reported in February 2014 to have stolen up to \$220,000 in cryptocurrencies including bitcoins from 85 wallets.^[299] Security company Trustwave, which tracked the malware, reports that its latest version was able to steal 30 types of digital currency.^[300]

A type of Mac malware active in August 2013, Bitvanity posed as a vanity wallet address generator and stole addresses and private keys from other bitcoin client software.^[301] A different trojan for Mac OS X, called CoinThief was reported in February 2014 to be responsible for multiple bitcoin thefts.^[301] The software was hidden in versions of some cryptocurrency apps on Download.com and MacUpdate.^[301]

Ransomware

Another type of bitcoin-related malware is ransomware. One program called CryptoLocker, typically spread through legitimate-looking email attachments, encrypts the hard drive of an infected computer, then displays a countdown timer and demands a ransom, usually two bitcoins, to decrypt it.^[302] Massachusetts police said they paid a 2 bitcoin ransom in November 2013, worth more than \$1,300 at the time, to decrypt one of their hard drives.^[303] Linkup, a combination ransomware and bitcoin mining program that surfaced in February 2014, disables internet access and demands credit card information to restore it, while secretly mining bitcoins.^[302]

Security

Various potential attacks on the bitcoin network and its use as a payment system, real or theoretical, have been considered. The bitcoin protocol includes several features that protect it against some of those attacks, such as unauthorized spending, double spending, forging bitcoins, and tampering with the block chain.^[46] Other attacks, such as theft of private keys, require due care by users.

Unauthorized spending

Unauthorized spending is mitigated by bitcoin's implementation of public-private key cryptography. When Alice sends a bitcoin to Bob, Bob becomes the new owner of the bitcoin. Eve observing the transaction might want to spend the bitcoin Bob just received, but she cannot sign the transaction without the knowledge of Bob's private key.^[13]

Double spending

A specific problem that an internet payment system must solve is double-spending, whereby a user pays the same coin to two or more different recipients. An example of such a problem would be if Eve sent a bitcoin to Alice and later sent the same bitcoin to Bob. The bitcoin network guards against double-spending by recording all bitcoin transfers in a ledger (the block chain) that is visible to all users, and ensuring for all transferred bitcoins that they haven't been previously spent.^{[13]:4}

Race attack

If Eve offers to pay Alice a bitcoin in exchange for goods and signs a corresponding transaction, it is still possible that she also creates a different transaction at the same time sending the same bitcoin to Bob. By the rules, the network accepts only one of the transactions. This is called race attack, since there is a race which transaction will be accepted first. Alice can reduce the risk of race attack stipulating that she will not deliver the goods until Eve's payment to Alice appears in the block chain.^[304]

A variant race attack (which has been called a Finney attack by reference to Hal Finney) requires the participation of a miner. Instead of sending both payment requests (to pay Bob and Alice with the same coins) to the network, Eve issues only Alice's payment request to the network, while the accomplice tries to mine a block that includes the payment to Bob instead of Alice. There is a positive probability that the rogue miner will succeed before the network, in which case the payment to Alice will be rejected. As with the plain double-spending attack, Alice can reduce the risk of a Finney attack by waiting for the payment to be included in the block chain.^[305]

History modification

The other principal way to steal bitcoins would be to modify block chain ledger entries.

For example, Eve could buy something from Alice, like a sofa, by adding a signed entry to the block chain ledger equivalent to *Eve pays Alice 100 bitcoins*. Later, after receiving the sofa, Eve could modify that block chain ledger entry to read instead: *Eve pays Alice 1 bitcoin*, or replace Alice's address by another of Eve's addresses. Digital signatures cannot prevent this attack: Eve can simply sign her entry again after modifying it.

To prevent modification attacks, each block of transactions that is added to the block chain includes a cryptographic hash code that is computed from the hash of the previous block as well as all the information in the block itself. When the bitcoin software notices two competing block chains, it will automatically assume that the chain with the greatest amount of work to produce it is the valid one. Therefore, in order to modify an already recorded transaction (as in the above example), the attacker would have to recalculate not just the modified block, but all the blocks after the modified one, until the modified chain contains more work than the legitimate chain that the rest of the network has been building in the meantime. Consequently, for this attack to succeed, the attacker must outperform the honest part of the network.^[46]

Each block that is added to the block chain, starting with the block containing a given transaction, is called a confirmation of that transaction. Ideally, merchants and services that receive payment in bitcoin should wait for at least one confirmation to be distributed over the network, before assuming that the payment was done. The more confirmations that the merchant waits for, the more difficult it is for an attacker to successfully reverse the transaction in a block chain—unless the attacker controls more than half the total network power, in which case it is called a 51% attack.^[306] For example, if the attacker possesses 10% of the calculation power of the bitcoin network and the shop requires 6 confirmations for a successful transaction, the probability of success of such an attack will be 0.02428%.^[11]

Selfish mining

This attack was first introduced by Ittay Eyal and Emin Gun Sirer at the beginning of November 2013.^[307] In this attack, the attacker finds blocks but does not broadcast them. Instead, the attacker mines their own private chain and eventually (when another miner or network of miners finds their own block) publishes several private blocks in a row. This forces the "honest" network to abandon their previous work and switch to the attacker's branch. As a result, honest miners lose a significant part of their revenue, while the attacker increases their profits due to changes in relative hashpowers.

According to the authors, a rational miner observing a selfish mining attacker would have an incentive to join the attacker's pool, thereby increasing the attacker's hashpower. This makes the attack and incentives even stronger, thus potentially leading to a 51% attack and the collapse of the currency.

Gavin Andresen and Ed Felten disagreed with this conclusion,^[308] Felten defending his assertion that the bitcoin protocol is incentive compatible.^[28] The original authors responded that the disagreement stemmed from Felten's misunderstanding of how miners are compensated in mining pools,^[309] that the assertion was in error, given the presence of a strategy that dominates honest mining, and that the error stemmed from Felten et al. not modeling block withholding attacks in their analysis.^[310]

Deanonymisation of clients

Along with transaction graph analysis, which may reveal connections between bitcoin addresses (pseudonyms),^{[2][311]} there is a possible attack^[312] which links a user's pseudonym to its IP address, even if the peer is using Tor. The attack makes use of bitcoin mechanisms of relaying peer addresses and anti-DoS protection. The cost of the attack on the full bitcoin network is under €1500 per month.^[312]

Alternative applications of the block chain

In January 2015 IBM's Institute for Business Value announced ADEPT (Autonomous Decentralized Peer-to-Peer Telemetry) where network-connected devices can interact autonomously on the Internet of things using freely available technology including bittorrent, Telehash, and bitcoin.^[313] This is not an IBM product^[313] but instead a concept system.^[314] IBM has also explored using the block chain as part of a payment system that would allow transactions in major currencies.^[315]

In May 2015 NASDAQ OMX Group announced its intention to use bitcoins of negligible value, called "colored coins", to represent and transfer pre-IPO trading shares on its Nasdaq Private Markets.^{[316][317]} In the same month the government of Honduras announced plans to use Bitcoin technology to host a land title registry.^[318]

Block chain spam

While it is possible to store any digital file in the block chain, the larger the transaction size, the larger any associated fees become.^[59] Various items have been embedded, including URLs to child pornography, an ASCII art image of Ben Bernanke, material from the Wikileaks cables, prayers from bitcoin miners, and the original bitcoin whitepaper.^[319]

In the media

Several lighthearted songs celebrating bitcoin have been released.^[320] U.S. comedians have also made fun of bitcoin.^[321]

In Season 3 CBS show *The Good Wife* featured an episode alluding to the creator of bitcoin as well as the FBI investigating the case. The episode titled 'Bitcoin for Dummies' was shown in early 2012.^[322]

A bitcoin documentary film called *The Rise and Rise of Bitcoin* was released in late 2014 and features interviews with people who use bitcoin such as a computer programmer and a drug dealer.^[323]

In the fall of 2014, undergraduate students at the Massachusetts Institute of Technology (MIT) each received bitcoins worth \$100 "to better understand this emerging technology". The bitcoins were not provided by MIT but rather the MIT Bitcoin Club, a student-run club.^{[324][325]} Similar initiatives have been created by students and groups at other universities, such as Stanford University and the University of California, Berkeley.

In early 2015, the CNN series *Inside Man* featured an episode about bitcoin. Filmed in July, 2014, it featured Morgan Spurlock living off of bitcoins for a week to figure out whether the world is ready for a new kind of money.^[326]

In science fiction novel *Neptune's Brood* by Charles Stross a modification of bitcoin is used as the universal interstellar payment system. The functioning of the system is a major plot element of the book.^[327]

Bibliography

- Paul Vigna, Michael Casey (January 27, 2015). *The Age of Cryptocurrency: How Bitcoin and Digital Money Are Challenging the Global Economic Order*. St. Martin's Press. ISBN 1250065631.

See also

- Alternative currency
- Alternative Finance
- Bitcoin faucet
- Crypto-anarchism
- Decentralized autonomous organization
- Electronic money
- Private currency
- Proof-of-work system
- Tidbit
- World currency

Notes

- Bitcoin does not have a central authority.^[1]
- As of 2014, BTC is the most commonly used code.^[5]
- As of 2014, XBT is used by Bloomberg L.P.,^[6] CNNMoney,^[7] and xe.com.^[8]
- Bitcoin Foundation will attempt to establish a Unicode symbol for bitcoin. The leading candidates are B(letter B with combining double vertical stroke overlay), ฿ (the Thai Baht symbol), and ₮ (B with stroke, Unicode U+0243).^[5]
- The word *bitcoin* is a compound of the words *bit* and *coin*.^[10] The white paper that defined bitcoin^[11] frequently uses the shorter *coin*.
- It is not known whether the name *Satoshi Nakamoto* is real or a pseudonym, or if it represents one person or a group.
- There is no uniform convention for *bitcoin* capitalization. Some sources use *Bitcoin*, capitalized, to refer to the technology and network and *bitcoin*, lowercase, to refer to the unit of account.^[15] The WSJ^[16] and The Chronicle of Higher Education^[17] advocate use of lowercase *bitcoin* in all cases. This article follows the latter convention.
- DigiCash was first used for a transaction in 1994,^[21] and OpenCoin, now known as Ripple, had code written prior to November 2008.^[22]
- It is misleading to think that there is an analogy between gold mining and bitcoin mining. The fact is that gold miners are rewarded for producing gold, while bitcoin miners are not rewarded for producing bitcoins; they are rewarded for their record-keeping services.^[44]
- Some of these firms use bitcoin payment processors such as BitPay and Coinbase and do not handle or store bitcoins themselves.^[92]
- As of 2015 the number of merchants accepting bitcoin has passed 100,000.^[125]
- The price of 1 bitcoin in U.S. dollars.
- Volatility is calculated on a yearly basis. All yearly volatilities exceed 60%.

References

- "Statement of Jennifer Shasky Calvery, Director Financial Crimes Enforcement Network United States Department of the Treasury Before the United States Senate Committee on Banking, Housing, and Urban Affairs Subcommittee on National Security and International Trade and Finance Subcommittee on Economic Policy" (http://www.fincen.gov/news_room/testimony/html/20131119.html). *fincen.gov*. Financial Crimes Enforcement Network. 19 November 2013. Retrieved 1 June 2014.
- Ron Dorit; Adi Shamir (2012). "Quantitative Analysis of the Full Bitcoin Transaction Graph" (<http://eprint.iacr.org/2012/584.pdf>) (PDF). Cryptology ePrint Archive. Retrieved 18 October 2012.
- "BitPay, Bitcoin, and where to put that decimal point" (<http://blog.bitpay.com/2014/05/02/bitpay-bitcoin-and-where-to-put-that-decimal-point.html>).
- Jason Mick (12 June 2011). "Cracking the Bitcoin: Digging Into a \$131M USD Virtual Currency" (<http://www.dailytech.com/Cracking+the+Bitcoin+Digging+Into+a+131M+USD+Virtual+Currency/article21878.htm>). Daily Tech. Retrieved 30 September 2012.
- Nermin Hajdarbegovic (7 October 2014). "Bitcoin Foundation to Standardise Bitcoin Symbol and Code Next Year" (<http://www.coindesk.com/bitcoin-foundation-standardise-bitcoin-symbol-code-next-year/>). CoinDesk. Retrieved 28 January 2015.
- Romain Dillet (9 August 2013). "Bitcoin Ticker Available On Bloomberg Terminal For Employees" (<http://techcrunch.com/2013/08/09/bitcoin-ticker-available-on-bloomberg-terminal/>). TechCrunch. Retrieved 2 November 2014.
- "Bitcoin Composite Quote (XBT)" (<http://money.cnn.com/quote/quote.html?symb=XBT>). *CNN Money*. CNN. Retrieved 2 November 2014.
- "XBT - Bitcoin" (<http://www.xe.com/currency/xbt-bitcoin/>). xe.com. Retrieved 2 November 2014.
- Andreas M. Antonopoulos (April 2014). *Mastering Bitcoin. Unlocking Digital Crypto-Currencies* (<http://chimera.labs.oreilly.com/books/1234000001802/ch01.html>). O'Reilly Media. Retrieved 23 October 2014.
- "bitcoin" (<http://www.oxforddictionaries.com/definition/english/bitcoin>). Oxford University Press. Retrieved 28 December 2014.
- "Bitcoin: A Peer-to-Peer Electronic Cash System" (<https://bitcoin.org/bitcoin.pdf>) (PDF). bitcoin.org. October 2008. Retrieved 28 April 2014.
- Davis, Joshua (10 October 2011). "The Crypto-Currency: Bitcoin and its mysterious inventor" (http://www.newyorker.com/reporting/2011/10/10/111010fa_fact_davis). *The New Yorker*. Retrieved 31 October 2014.
- Jerry Brito and Andrea Castillo (2013). "Bitcoin: A Primer for Policymakers" (http://mercatus.org/sites/default/files/Brito_BitcoinPrimer.pdf) (PDF). *Mercatus Center*. George Mason University. Retrieved 22 October 2013.
- Joshua Kopstein (12 December 2013). "The Mission to Decentralize the Internet" (<http://www.newyorker.com/tech/elements/the-mission-to-decentralize-the-internet>). The New Yorker. Retrieved 30 December 2014. "The network's "nodes"—users running the bitcoin software on their computers—collectively check the integrity of other nodes to ensure that no one spends the same coins twice. All transactions are published on a shared public ledger, called the "block chain""
- Bustillos, Maria (2 April 2013). "The Bitcoin Boom" (<http://www.newyorker.com/online/blogs/elements/2013/04/the-future-of-bitcoin.html>). *The New Yorker*. Condé Nast. Retrieved 22 December 2013. "Standards vary, but there seems to be a consensus forming around Bitcoin, capitalized, for the system, the software, and the network it runs on, and bitcoin, lowercase, for the currency itself."
- Vigna, Paul (3 March 2014). "BitBeat: Is It Bitcoin. or bitcoin? The Orthography of the Crvptographv"

- (<http://blogs.wsj.com/moneybeat/2014/03/14/bitbeat-is-it-bitcoin-or-bitcoin-the-orthography-of-the-cryptography>). *WSJ*. Retrieved 21 April 2014.
17. Metcalf, Allan (14 April 2014). "The latest style" (<http://chronicle.com/blogs/linguafranca/2014/04/11/the-latest-style/>). *Lingua Franca* blog. The Chronicle of Higher Education (chronicle.com). Retrieved 19 April 2014.
 18. "Drug market moving quickly online, global user survey finds" (<http://www.scmp.com/news/world/article/1482245/drug-market-moving-quickly-online-global-user-survey-finds>). *South China Morning Post*. South China Morning Post Publishers. 14 April 2014. Retrieved 7 January 2015.
 19. Sparkes, Matthew (9 June 2014). "The coming digital anarchy" (<http://www.telegraph.co.uk/technology/news/10881213/The-coming-digital-anarchy.html>). *The Telegraph*. Telegraph Media Group Limited. Retrieved 7 January 2015.
 20. "This Company Is Now the Largest in the World to Accept Bitcoin" (<http://www.entrepreneur.com/article/234340>). *entrepreneur.com*. Entrepreneur Media, Inc. 30 May 2014. Retrieved 7 January 2015.
 21. "World's first electronic cash payment over computer networks." (https://w2.eff.org/Privacy/Digital_money/?f=digicash.announce.txt). Electronic Frontier Foundation. 26 May 1994.
 22. "OpenCoin/opencoin-historic" (<https://github.com/OpenCoin/opencoin-historic/commit/ecde30f6f5c00e4bf0381ee4df8cfd3eba5552f>). *github.com*. GitHub, Inc. Retrieved 8 May 2015.
 23. Sagona-Stophel, Katherine. "Bitcoin 101 white paper" (<http://site.thomsonreuters.com/business-unit/legal/digital-economy/bitcoin-101.pdf>) (PDF). Thomson Reuters.
 24. Espinoza, Javier (22 September 2014). "Is It Time to Invest in Bitcoin? Cryptocurrencies Are Highly Volatile, but Some Say They Are Worth It" (<http://online.wsj.com/articles/how-to-decipher-cryptocurrencies-1411333011>). *Journal Reports* (The Wall Street Journal). Retrieved 3 November 2014.
 25. "Cambridge Judge Business School: Cambridge Centre for Alternative Finance" (<https://www.jbs.cam.ac.uk/faculty-research/centres/alternative-finance/>). *Jbs.cam.ac.uk*. Retrieved 2015-07-24.
 26. "What is Bitcoin?" (<http://money.cnn.com/infographic/technology/what-is-bitcoin/>). CNN Money.
 27. Natasha Lomas (16 September 2013). "BitPay Passes 10,000 Bitcoin-Accepting Merchants On Its Payment Processing Network" (<http://techcrunch.com/2013/09/16/bitpay-10000-merchants/>). *Techcrunch*. Techcrunch.com. Retrieved 21 October 2013.
 28. Joshua A. Kroll, Ian C. Davey, Edward W. Felten (11–12 June 2013). "The Economics of Bitcoin Mining, or Bitcoin in the Presence of Adversaries" (<http://www.weis2013.econinfosec.org/papers/KrollDaveyFeltenWEIS2013.pdf>) (PDF). *The Twelfth Workshop on the Economics of Information Security (WEIS 2013)*. Retrieved 8 May 2014. "A transaction fee is like a tip or gratuity left for the miner."
 29. Wingfield, Nick (30 October 2013). "Bitcoin Pursues the Mainstream" (<http://www.nytimes.com/2013/10/31/technology/bitcoin-pursues-the-mainstream.html>). *The New York Times*. Retrieved 4 November 2013.
 30. "Warning to consumers on virtual currencies" (<http://www.webcitation.org/6MCBOsSXG>). European Banking Authority. 12 December 2013. Archived from the original (<http://www.eba.europa.eu/documents/10180/16136/EBA+Warning+on+Virtual+Currencies.pdf>) (PDF) on 28 December 2013. Retrieved 23 December 2013.
 31. Orcutt, Mike (18 February 2015). "Is Bitcoin Stalling?" (<http://www.technologyreview.com/news/535221/is-bitcoin-stalling/>). *MIT Technology Review*. Retrieved 20 Feb 2015.
 32. Lavin, Tim (8 August 2013). "The SEC Shows Why Bitcoin Is Doomed" (<http://www.bloombergview.com/articles/2013-08-08/did-the-sec-just-validate-bitcoin-no->). *bloomberg.com* (Bloomberg LP). Retrieved 20 October 2013.
 33. Tracy, Ryan (Nov 5, 2013). "Bitcoin Comes Under Senate Scrutiny" (<http://blogs.wsj.com/washwire/2013/11/05/bitcoin-comes-under-senate-scrutiny>). *Washington Wire*. Wall Street Journal. Retrieved 20 December 2014.
 34. "Bitcoins Virtual Currency: Unique Features Present Challenges for Deterring Illicit Activity" (http://www.wired.com/images_blogs/threatlevel/2012/05/Bitcoin-FBI.pdf) (PDF). *Cyber Intelligence Section and Criminal Intelligence Section*. FBI. 24 April 2012. Retrieved 2 November 2014.
 35. Timothy B. Lee and Hayley Tsukayama (2 October 2013). "Authorities shut down Silk Road, the world's largest Bitcoin-based drug market" (http://articles.washingtonpost.com/2013-10-02/business/42613812_1_digital-currency-federal-authorities-reputation). *The Washington Post*. Retrieved 21 October 2013.
 36. Tracy, Ryan (18 November 2013). "Authorities See Worth of Bitcoin" (<http://online.wsj.com/articles/SB10001424052702304439804579205740125297358>). *Markets* (The Wall Street Journal). Retrieved 28 November 2014.
 37. "Regulation of Bitcoin in Selected Jurisdictions" (<http://www.loc.gov/law/help/bitcoin-survey/regulation-of-bitcoin.pdf>) (PDF). The Law Library of Congress, Global Legal Research Center. January 2014. Retrieved 26 August 2014.
 38. Katie Pisa and Natasha Maguder (9 July 2014). "Bitcoin your way to a double espresso" (<http://edition.cnn.com/2014/06/18/business/bitcoin-your-way-to-a-double-espresso/>). *cnn.com*. CNN. Retrieved 23 April 2015.
 39. "Press Release October 7, 2014: Bitcoin Foundation Financial Standards Working Group Leads the Way for Mainstream Bitcoin Adoption" (<https://bitcoinfoundation.org/press-releases/press-release-october-7-2014-bitcoin-foundation-financial-standards-working-group-leads-the-way-for-mainstream-bitcoin-adoption-2/>). *Press Release*. Bitcoin Foundation. 7 October 2014. Retrieved 7 November 2014.
 40. "Man Throws Away 7,500 Bitcoins, Now Worth \$7.5 Million" (<http://washington.cbslocal.com/2013/11/29/man-throws-away-7500-bitcoins-now-worth-7-5-million/>). *CBS DC*. 29 November 2013. Retrieved 23 January 2014.
 41. Don W. Tyler, Jeff Isenhardt, Anne Mueller, Christoph Sadil (8 May 2014). "Qr code-enabled p2p payment systems and methods.US 20140129428 A1" (<http://appft1.uspto.gov/netacgi/nph-Parser?Sect1=PTO1&Sect2=HITOFF&d=PG01&p=1&u=/netahtml/PTO/srchnum.html&r=1&f=G&I=50&s1=20140129428.PGNR.>) (Patent application). *uspto.gov*. Retrieved 20 January 2015.
 42. "Charts" (<https://blockchain.info/charts>). *Blockchain.info*. Retrieved 2 November 2014.
 43. <https://bitcointalk.org/index.php?topic=195004.0>
 44. Andolfatto, David (31 March 2014). "Bitcoin and Beyond: The Possibilities and Pitfalls of Virtual Currencies" (<http://www.stlouisfed.org/dialogue-with-the-fed/assets/Bitcoin-3-31-14.pdf>) (PDF). *Dialogue with the Fed*. Federal Reserve Bank of St. Louis. Retrieved 16 April 2014.
 45. "Difficulty History" (https://blockchain.info/charts/difficulty?timespan=all&showDataPoints=false&daysAverageString=1&show_header=true&scale=0&address=) (The ratio of all hashes over valid hashes is $D \times 4295032833$, where D is the published "Difficulty" figure.). *Blockchain.info*. Retrieved 26 March 2015.
 46. Ramzan, Zulfikar (2014). "Bitcoin: What is it?" (<http://www.khanacademy.org/economics-finance-domain/core-finance/money-and-banking/bitcoin/v/bitcoin-what-is-it>). The Khan Academy. Retrieved 5 April 2014.
 47. Mills, Kelly (3 April 2014). "Bitcoins lose viability" (<http://arbiteronline.com/2014/04/03/bitcoins-likely-viable-future/>). *The Arbiter*. Boise State Student Media. Retrieved 14 April 2014.
 48. Wang, Luqin; Liu, Yong. "Exploring Miner Evolution in Bitcoin Network" (<http://wan.poly.edu/pam2015/papers/23.pdf>) (PDF). NYU Polytechnic School of Engineering. Retrieved 15 February 2015.
 49. Rosenfeld, Meni. "Analysis of Bitcoin Pooled Mining Reward Systems" (<http://arxiv.org/pdf/1112.4980.pdf>) (PDF). Retrieved 14 February 2015.
 50. Peter Svensson (17 June 2014). "Bitcoin faces biggest threat yet: a miner takeover" (<http://phys.org/news/2014-06-bitcoin-biggest-threat-miner-takeover.html>). Retrieved 8 January 2015.
 51. Rockman, Simon (17 January 2014). "Manic miners: Ten Bitcoin generating machines" (http://www.theregister.co.uk/2014/01/17/ten_bitcoin_miners/). *The Register*. Retrieved 13 February 2014.
 52. Bays, Jason (9 April 2014). "Bitcoin offers speedy currency, poses high risks" (http://www.purdueexponent.org/features/article_46e4aefa-dc11-5c5e-972b-80b4e45a70e1.html). *Purdue Exponent*. The Exponent Online. Retrieved 14 April 2014.
 53. "The magic of mining" (<http://www.economist.com/news/business/21638124-minting-digital-currency-has-become-big-ruthlessly-competitive-business-magic>). *The economist*. 13 January 2015. Retrieved 13 January 2015.
 54. Gimein, Mark (13 April 2013). "Virtual Bitcoin Mining Is a Real-World Environmental Disaster" (<http://www.bloomberg.com/news/articles/2013-04-12/virtual-bitcoin-mining-is-a-real-world-environmental-disaster>). *Bloomberg Business*. Bloomberg LP. Retrieved 22 April 2015.
 55. Ashlee Vance (14 November 2013). "2014 Outlook: Bitcoin Mining Chips, a High-Tech Arms Race" (<http://www.businessweek.com/articles/2013-11-14/2014-outlook-bitcoin-mining-chips-a-high-tech-arms-race>). *Businessweek*. Retrieved 24 November 2013.
 56. "Block #210000" (<https://blockchain.info/block/000000000000048b95347e83192f69cf0366076336c639f9b7228e9ba171342e>). *Blockchain*.
 57. Ritchie S. King, Sam Williams, David Yanofsky (17 December 2013). "By reading this article, you're mining bitcoins" (<http://qz.com/154877/by-reading-this-page-you-are-mining-bitcoins/>). *qz.com*. Atlantic Media Co. Retrieved 17 December 2013.

- ...this-page-you-are-including-bitcoins/). *qz.com*. Quantic Media Co. Retrieved 17 December 2013.
58. "How much will the transaction fee be?" (<https://bitcoin.org/en/faq#how-much-will-the-transaction-fee-be>). *FAQ*. Bitcoin Foundation. Retrieved 19 March 2014.
 59. "How much will the transaction fee be?" (<http://bitcoinfees.com/>). Bitcoinfees.com. Retrieved 30 November 2014.
 60. Adam Serwer and Dana Liebelson (10 April 2013). "Bitcoin, Explained" (<http://www.motherjones.com/politics/2013/04/what-is-bitcoin-explained>). *motherjones.com*. Mother Jones. Retrieved 26 April 2014.
 61. Villasenor, John (26 April 2014). "Secure Bitcoin Storage: A Q&A With Three Bitcoin Company CEOs" (<http://www.forbes.com/sites/johnvillasenor/2014/04/26/secure-bitcoin-storage-a-qa-with-three-bitcoin-company-ceos/>). *forbes.com*. Forbes. Retrieved 26 April 2014.
 62. "Bitcoin: Bitcoin under pressure" (<http://www.economist.com/news/technology-quarterly/21590766-virtual-currency-it-mathematically-elegant-increasingly-popular-and-highly>). *The Economist*. 30 November 2013. Retrieved 30 November 2013.
 63. Skudnov, Rostislav (2012). *Bitcoin Clients* (http://publications.theseus.fi/bitstream/handle/10024/47166/Skudnov_Rostislav.pdf?sequence=1) (PDF) (Bachelor's Thesis). Turku University of Applied Sciences. Retrieved 16 January 2014.
 64. Jon Matonis (26 April 2012). "Be Your Own Bank: Bitcoin Wallet for Apple" (<http://www.forbes.com/sites/jonmatonis/2012/04/26/be-your-own-bank-bitcoin-wallet-for-apple/>). Forbes. Retrieved 17 November 2014.
 65. Bill Barhydt (4 Jun 2014). "3 reasons Wall Street can't stay away from bitcoin" (<http://www.cnbc.com/id/101711220>). NBCUniversal. Retrieved 2 April 2015.
 66. Staff, Verge (13 December 2013). "Casascius, maker of shiny physical bitcoins, shut down by Treasury Department" (<http://www.theverge.com/2013/12/13/5207256/casascius-maker-of-shiny-physical-bitcoins-shut-down-by-treasury>). The Verge. Retrieved 10 January 2014.
 67. Eric Mu (15 October 2014). "Meet Trezor, A Bitcoin Safe That Fits Into Your Pocket" (<http://www.forbes.com/sites/ericxlm/2014/10/15/meet-trezor-a-bitcoin-safe-that-can-fit-into-your-pocket/>). *Forbes Asia* (Forbes). Retrieved 31 October 2014.
 68. "Bitcoin-Qt/bitcoind version 0.5.0" (<https://bitcointalk.org/index.php?topic=52480.0>). Retrieved 6 May 2015.
 69. "Bitcoin Core version 0.9.0 released" (<https://bitcoin.org/en/release/v0.9.0>). *bitcoin.org*. Retrieved 8 January 2015.
 70. Simonite, Tom (5 September 2013). "Mapping the Bitcoin Economy Could Reveal Users' Identities" (<http://www.technologyreview.com/news/518816/mapping-the-bitcoin-economy-could-reveal-users-identities/>). *MIT Technology Review*. Retrieved 2 April 2014.
 71. Lee, Timothy (21 August 2013). "Five surprising facts about Bitcoin" (<http://www.washingtonpost.com/blogs/the-switch/wp/2013/08/21/five-surprising-facts-about-bitcoin-2/>). *washingtonpost.com* (The Washington Post). Retrieved 2 April 2014.
 72. McMillan, Robert (6 June 2013). "How Bitcoin lets you spy on careless companies" (<http://www.wired.co.uk/news/archive/2013-06/06/bitcoin-retail>). *wired.co.uk*. Conde Nast. Retrieved 2 April 2014.
 73. Matonis, Jon (5 June 2013). "The Politics Of Bitcoin Mixing Services" (<http://www.forbes.com/sites/jonmatonis/2013/06/05/the-politics-of-bitcoin-mixing-services/>). *forbes.com* (Forbes). Retrieved 2 April 2014.
 74. Bar-El, Hagai (3 April 2014). "Bitcoin does not provide anonymity" (<https://web.archive.org/web/20140407065405/http://www.hbarel.com/bitcoin-does-not-provide-anonymity>). Archived from the original (<http://www.hbarel.com/bitcoin-does-not-provide-anonymity>) on 7 April 2014. Retrieved 26 April 2015.
 75. Ben-Sasson, Eli; Chiesa, Alessandro; Garman, Christina; Green, Matthew; Miers, Ian; Tromer, Eran; Virza, Madars (2014). "Zerocash: Decentralized Anonymous Payments from Bitcoin" (<http://zerocash-project.org/media/pdf/zerocash-oakland2014.pdf>) (PDF). *2014 IEEE Symposium on Security and Privacy*. IEEE computer society. Retrieved 31 October 2014.
 76. Miers, Ian; Garman, Christina; Green, Matthew; Rubin, Aviel. "Zerocoin: Anonymous Distributed E-Cash from Bitcoin" (<http://isi.jhu.edu/~mgreen/ZerocoinOakland.pdf>) (PDF). Johns Hopkins University. Retrieved 15 February 2015.
 77. Greenberg, Andy. "'Dark Wallet' Is About to Make Bitcoin Money Laundering Easier Than Ever" (<http://www.wired.com/2014/04/dark-wallet/>). Retrieved 15 February 2015.
 78. "Hal Finney received the first Bitcoin transaction. Here's how he describes it. Share on Facebook Share on Twitter Share on LinkedIn Share via Email More Options Resize Text Print Article Comments 11" (<http://www.washingtonpost.com/blogs/the-switch/wp/2014/01/03/hal-finney-received-the-first-bitcoin-transaction-heres-how-he-describes-it/>).
 79. Popper, Nathaniel (30 August 2014). "Hal Finney, Cryptographer and Bitcoin Pioneer, Dies at 58" (http://www.nytimes.com/2014/08/31/business/hal-finney-cryptographer-and-bitcoin-pioneer-dies-at-58.html?_r=1). *NYTimes*. Retrieved 2 September 2014.
 80. Wallace, Benjamin (23 November 2011). "The Rise and Fall of Bitcoin" (http://www.wired.com/magazine/2011/11/mf_bitcoin/). *Wired*. Retrieved 4 November 2013.
 81. Johannes Henning; Robin Schreiber (9 July 2013). "Bitcoin Cloud Security Mechanisms Seminar" (<https://www.dcl.hpi.uni-potsdam.de/teaching/cloudsec/presentations/bitcoin.pdf>) (PDF). *www.dcl.hpi.uni-potsdam.de*. Hasso Plattner Institute. Retrieved 15 February 2015.
 82. Nakamoto, Satoshi. "Re overflow bug serious" (<https://bitcointalk.org/index.php?topic=823.msg9734#msg9734>). *Bitcointalk*. Retrieved 1 February 2015.
 83. Lee, Timothy (11 March 2013). "Major glitch in Bitcoin network sparks sell-off; price temporarily falls 23%" (<http://arstechnica.com/business/2013/03/major-glitch-in-bitcoin-network-sparks-sell-off-price-temporarily-falls-23/>). <http://arstechnica.com>. Retrieved 15 February 2015.
 84. Skelton, Andy (15 November 2012). "Pay Another Way: Bitcoin" (<http://en.blog.wordpress.com/2012/11/15/pay-another-way-bitcoin/>). WordPress. Retrieved 24 April 2014.
 85. Franceschi-Bicchierai, Lorenzo (18 April 2013). "OKCupid Now Accepts Bitcoin" (<http://mashable.com/2013/04/17/okcupid-bitcoin/>). Mashable. Retrieved 24 April 2014.
 86. AtomicMall.com (17 November 2013). "Atomic Mall adds Bitcoin payments for approved merchants" (<http://www.powersellersunite.com/about45219.html>). *powersellersunite.com*. Retrieved 8 April 2014.
 87. Jane McEntegart (26 January 2014). "TigerDirect is Now Accepting Bitcoin As Payment" (<http://www.tomshardware.com/news/tigerdirect-bitcoin-bitpay-payments,25859.html>). Tom's hardware. Retrieved 28 August 2014.
 88. Vaishampayan, Saumya (9 January 2014). "Bitcoin now accepted on Overstock.com through VC-backed Coinbase" (<http://blogs.marketwatch.com/thetell/2014/01/09/bitcoin-now-accepted-on-overstock-com-through-vc-backed-coinbase/>). *marketwatch.com*. Wall Street Journal. Retrieved 10 February 2014.
 89. Biggs, John (11 June 2014). "Expedia Now Accepts Bitcoin For Your Crypto-Vacations" (<http://techcrunch.com/2014/06/11/expedia-now-accepts-bitcoin-for-your-crypto-vacations/>). Techcrunch. Retrieved 12 June 2014.
 90. Flacy, Mike (19 July 2014). "Dell, Newegg Start Accepting Bitcoin as Payment" (<http://www.digitaltrends.com/web/dell-newegg-start-accepting-bitcoin-payment/#!bv9oFm>). Digital Trends. Retrieved 5 August 2014.
 91. Tom Warren (11 December 2014). "Microsoft now accepts Bitcoin to buy Xbox games and Windows apps" (<http://www.theverge.com/2014/12/11/7375771/microsoft-supports-bitcoin-payments>). *The Verge* (Vox Media). Retrieved 11 December 2014.
 92. Chavez-Dreyfuss, Gertrude; Connor, Michael (28 August 2014). "Bitcoin shows staying power as online merchants chase digital sparkle" (<http://www.reuters.com/article/2014/08/28/us-usa-bitcoin-retailers-analysis-idUSKBN0GS0AG20140828>). Reuters. Retrieved 28 August 2014.
 93. Cindy Cohn, Peter Eckersley, Rainey Reitman, and Seth Schoen (17 May 2013). "EFF Will Accept Bitcoins to Support Digital Liberty" (<https://www.eff.org/deeplinks/2013/05/eff-will-accept-bitcoins-support-digital-liberty>). Electronic Frontier Foundation. Retrieved 27 April 2014.
 94. Rainey Reitman (20 January 2011). "Bitcoin - a Step Toward Censorship-Resistant Digital Currency" (<https://www.eff.org/deeplinks/2011/01/bitcoin-step-toward-censorship-resistant>). Electronic Frontier Foundation. Retrieved 21 November 2014.
 95. Cohn, Cindy (20 June 2011). "EFF and Bitcoin" (<https://www.eff.org/deeplinks/2011/06/eff-and-bitcoin>). Electronic Frontier Foundation. Retrieved 16 April 2014.
 96. Dillet, Romain (16 May 2013). "Feds Seize Assets From Mt. Gox's Dwolla Account, Accuse It Of Violating Money Transfer Regulations" (<http://techcrunch.com/2013/05/16/mt-gox-dwolla-account-money-seizure/>). *TechCrunch*. Retrieved 15 May 2013.
 97. Farrell, Greg (3 October 2013). "FBI Snags Silk Road Boss With Own Methods" (<http://www.bloomberg.com/news/2013-10-03/fbi-snags-silk-road-boss-with-own-methods.html>). *Bloomberg* (New York). Retrieved 27 October 2013.
 98. Kapur, Saranya (15 October 2013). "China's Google Is Now Accepting Bitcoin" (<http://www.businessinsider.com/chinas-google-is-now-accepting-bitcoin->

- 2013-10). *businessinsider.com*. Business Insider, Inc. Retrieved 26 December 2013.
99. Natasha Lomas (18 November 2013). "As Chinese Investors Pile Into Bitcoin, China's Oldest Exchange, BTC China, Raises \$5M From Lightspeed" (<http://techcrunch.com/2013/11/18/btc-china-series-a/>). TechCrunch. Retrieved 10 January 2014.
 100. "BBC News - 'Legitimate' Bitcoin's value soars after Senate hearing" (<http://www.bbc.co.uk/news/technology-24986264>). Bbc.co.uk. 19 November 2013. Retrieved 10 January 2014.
 101. Lee, Cyrus (22 November 2013). "China no plans yet to legalize use of Bitcoins" (<http://www.zdnet.com/cn/china-no-plans-yet-to-legalize-use-of-bitcoins-7000023512/>). *ZDNet*. Retrieved 27 November 2013.
 102. Kelion, Leo (18 December 2013). "Bitcoin sinks after China restricts yuan exchanges" (<http://www.bbc.co.uk/news/technology-25428866>). *bbc.com* (BBC). Retrieved 20 December 2013.
 103. "China bans banks from bitcoin transactions" (<http://www.smh.com.au/business/markets/currencies/china-bans-banks-from-bitcoin-transactions-20131206-2yugy.html>). *The Sydney Morning Herald* (Reuters). 6 December 2013. Retrieved 31 October 2014.
 104. "Baidu Stops Accepting Bitcoins After China Ban" (<http://www.bloomberg.com/news/2013-12-07/baidu-stops-accepting-bitcoins-after-china-ban.html>). *Bloomberg* (New York). 7 December 2013. Retrieved 11 December 2013.
 105. "China bars use of virtual money for trading in real goods" (<http://english.mofcom.gov.cn/aarticle/newsrelease/commonnews/200906/20090606364208.html>). English.mofcom.gov.cn. 29 June 2009. Retrieved 10 January 2014.
 106. McMillan, Robert (29 October 2013). "Take a tour of Robocoin, the world's first Bitcoin ATM" (http://www.wired.com/wiredenterprise/2013/10/bitcoin_atm_gallery/). *Wired*. Retrieved 31 October 2014.
 107. Raskin, Max (18 November 2013). "U.S. Agencies to Say Bitcoins Offer Legitimate Benefits" (<http://www.bloomberg.com/news/2013-11-18/u-s-agencies-to-say-bitcoins-offer-legitimate-benefits.html>). *Bloomberg*. Retrieved 24 November 2013.
 108. Todd Wasserman (18 November 2013). "Bitcoin Tops \$600, Up 60x Over the Last Year" (<http://mashable.com/2013/11/18/bitcoin-600/>). Mashable.com. Retrieved 10 January 2014.
 109. Joel Fensch (2 January 2014). "Bitcoin Set to Boom in Latin America" (<http://blog.panampost.com/joel-fensch/2014/01/02/bitcoin-set-to-boom-in-latin-america/>). Blog.panampost.com. Retrieved 7 January 2014.
 110. Lee, Dave (27 January 2014). "US makes Bitcoin exchange arrests after Silk Road closure" (<http://www.bbc.co.uk/news/technology-25919482>). *bbc.co.uk* (BBC). Retrieved 28 January 2014.
 111. "MtGox gives bankruptcy details" (<http://www.bbc.com/news/technology-26420932>). *bbc.com*. BBC. 4 March 2014. Retrieved 13 March 2014.
 112. Biggs, John (10 February 2014). "What's Going On With Bitcoin Exchange Mt. Gox?" (<http://techcrunch.com/2014/02/10/whats-going-on-with-bitcoin-exchange-mt-gox/>). TechCrunch. Retrieved 26 February 2014.
 113. "MtGox bitcoin exchange files for bankruptcy" (<http://www.bbc.com/news/technology-25233230>). *bbc.com*. BBC. 28 February 2014. Retrieved 18 April 2014.
 114. Vigna, Paul (25 Feb 2014). "Five Things About Mt. Gox's Crisis" (<http://blogs.wsj.com/five-things/2014/02/25/5-things-about-mt-goxs-crisis/>). *The Wall Street Journal*. Dow Jones and Company. Retrieved 18 April 2014.
 115. Swan, Noelle (28 February 2014). "MtGox bankruptcy: Bitcoin insiders saw problems with the exchange for months" (<http://www.csmonitor.com/USA/USA-Update/2014/0228/MtGox-bankruptcy-Bitcoin-insiders-saw-problems-with-the-exchange-for-months>). *csmonitor.com*. The Christian Science Monitor. Retrieved 18 April 2014.
 116. "BitPay to Sponsor St. Petersburg Bowl in First Major Bitcoin Sports Deal" (<http://online.wsj.com/articles/bitpay-to-sponsor-st-petersburg-bowl-in-first-major-bitcoin-sports-deal-1403098202>). Retrieved 18 June 2014.
 117. Srivastava, Shivam (6 January 2015). "Bitcoin exchange Bitstamp suspends service after security breach" (<http://www.reuters.com/article/2015/01/06/us-bitstamp-cybersecurity-idUSKBN0KF0UH20150106>). *reuters.com*. Reuters. Retrieved 24 January 2015.
 118. Novak, Marja (9 January 2015). "Bitcoin exchange Bitstamp says to resume trading on Friday" (<http://www.reuters.com/article/2015/01/09/bitstamp-cybersecurity-idUSL6N0UO1DC20150109>). *reuters.com*. Reuters. Retrieved 24 January 2015.
 119. Russel, Jon (January 25, 2015). "Coinbase Is Opening The First Regulated Bitcoin Exchange In The U.S." (<http://techcrunch.com/2015/01/25/coinbase-us-bitcoin-exchange/>). *TechCrunch*. TechCrunch. Retrieved February 21, 2015.
 120. Popper, Nathaniel (January 28, 2015). "Coinbase, a Bitcoin Exchange, Is Operating Without Licenses So Far" (<http://dealbook.nytimes.com/2015/01/28/coinbase-a-bitcoin-exchange-is-operating-without-licenses-so-far/>). *New York Times*. New York Times. Retrieved February 21, 2015.
 121. Joyner, April (25 April 2014). "How bitcoin is moving money in Africa" (<http://www.usatoday.com/story/money/business/2014/04/25/ozy-bitcoin-africa-currency/8148853/>). *usatoday.com*. USA Today. Retrieved 25 May 2014.
 122. Murphy, Kate (31 July 2013). "Virtual Currency Gains Ground in Actual World" (<http://www.nytimes.com/2013/08/01/technology/personaltech/virtual-currency-gains-ground-in-actual-world.html>). The New York Times. Retrieved 6 May 2014. "A type of digital cash, bitcoins were invented in 2009 and can be sent directly to anyone, anywhere in the world."
 123. "The magic of mining" (<http://www.economist.com/news/business/21638124-minting-digital-currency-has-become-big-ruthlessly-competitive-business-magic>). *The Economist*. 8 January 2015. Retrieved 13 January 2015.
 124. "Free Exchange. Money from nothing. Chronic deflation may keep Bitcoin from displacing its rivals." (<http://www.economist.com/news/finance-and-economics/21599053-chronic-deflation-may-keep-bitcoin-displacing-its-fiat-rivals-money>). *The Economist*. 15 March 2014. Retrieved 25 March 2014.
 125. Cuthbertson, Anthony. "Bitcoin now accepted by 100,000 merchants worldwide" (<http://www.ibtimes.co.uk/bitcoin-now-accepted-by-100000-merchants-worldwide-1486613>). *International Business Times*. IBTimes Co., Ltd.
 126. Carter, Stephen L. (29 Nov 2013). "Building Better Bitcoins" (<http://www.bloombergview.com/articles/2013-11-29/building-better-bitcoins>). *Bloomberg View*. Bloomberg LP. Retrieved 25 May 2014. "A principal knock on bitcoins has been the claim that they are inherently insecure. The principal defense has been that they are as secure as "real" currency."
 127. Satran, Richard (15 May 2013). "How Did Bitcoin Become a Real Currency?" (<http://money.usnews.com/money/personal-finance/articles/2013/05/15/how-did-bitcoin-become-a-real-currency>). *Forbes*. Retrieved 22 December 2014.
 128. Chapman, Lizette (12 December 2013). "Coinbase to Push Bitcoin From Commodity to Currency, With \$25M From Investors" (<http://blogs.wsj.com/venturecapital/2013/12/12/with-25m-coinbase-to-push-bitcoin-from-commodity-to-currency/>). The Wall Street Journal. Retrieved 27 January 2014.
 129. Woodhill, Louis (4 November 2013). "Bitcoins Are Digital Collectibles, Not Real Money" (<http://www.forbes.com/sites/louiswoodhill/2013/04/11/bitcoins-are-digital-collectibles-not-real-money/>). Forbes. Retrieved 27 January 2014.
 130. Bergstra, J. A., Weijland, P. (February 2014). "Bitcoin: a money-like informational commodity" (<http://arxiv.org/pdf/1402.4778.pdf>) (PDF). *arXiv.org* (preprint arXiv:1402.4778.). Cornell University. p. 26.
 131. "China's Bitcoin Exchanges Say Banks Will Close Their Accounts" (<http://www.bloomberg.com/news/2014-04-10/china-s-bitcoin-exchanges-say-banks-will-close-their-accounts.html>). *Bloomberg*. 10 April 2014. Retrieved 11 April 2014. "The central bank will keep watching risks from Bitcoin, which is fundamentally not a currency but an investment target, Sheng Songcheng, head of the monetary authority's statistics department, told reporters in Beijing on Jan. 15 2014."
 132. Steadman, Ian (26 April 2013). "Study: 45 percent of Bitcoin exchanges end up closing" (<http://www.wired.co.uk/news/archive/2013-04/26/large-bitcoin-exchanges-attacks>). *Wired*. Retrieved 28 April 2013.
 133. Nermin Hajdarbegovic (24 March 2014). "Kraken Bitcoin Exchange Passes 'Proof of Reserves' Cryptographic Audit" (<http://www.coindesk.com/kraken-audit-proves-holds-100-bitcoins-reserve/>). Retrieved 13 January 2015.
 134. Lauren Orsini (23 October 2013). "Here's What Happened When I Bought Bitcoin In Person" (<http://www.businessinsider.com/heres-what-happened-when-i-bought-bitcoin-in-person-2013-10>). Business Insider. Retrieved 4 February 2014.
 135. Jervis, Rick (20 February 2014). "Bitcoin ATMs come to USA" (<http://www.usatoday.com/story/money/business/2014/02/19/bitcoin-atm-austin/5623387/>). *USA Today*. Retrieved 31 October 2014.
 136. Michael J. Casey (30 April 2014). "Bloomberg to List Bitcoin Prices, Offering Key Stamp of Approval" (<http://online.wsj.com/news/articles/SB10001424052702304893404579532471795644350?mg=reno64-wsj&url=http%3A%2F%2Fonline.wsj.com%2Farticle%2FSB10001424052702304893404579532471795644350.html>). *WSJ*. Retrieved 23 March 2015.
 137. CNBC (30 April 2014). "Bloomberg terminal now following bitcoin prices" (<http://www.cnbc.com/id/101628763>). Retrieved 23 March 2015.

138. Williams, Mark T. (21 October 2014). "Virtual Currencies – Bitcoin Risk" (<http://management.bu.edu/files/2014/10/Wlliams-World-Bank-10-21-2014.pdf>) (PDF). *World Bank Conference Washington DC*. Boston University. Retrieved 11 November 2014.
139. Mitsuru Iwamura; Tsutomu Matsu moto; Kenji Saito; Yukinobu Kitamura (24 July 2014). "Can We Stabilize the Price of Cryptocurrency?: Understanding the Design of Bitcoin and its Potential Competitiveness with the Central Bank Money" (<http://connection.mit.edu/Iwamura-Kitamura201407.pdf>) (PDF). *mit.edu*. Retrieved 8 January 2015. "First instability stems from an inflexible supply curve of Bitcoin against a change in the marginal cost of mining. This inflexibility amplifies the Bitcoin price volatility and the miners' revenue/reward absorbs a price change effect fully. No price stabilization mechanism works."
140. Wilkes, Tommy (11 April 2013). "Backer defends virtual currency Bitcoin after big fall" (<http://www.reuters.com/article/2013/04/11/us-bitcoin-currency-idUSBRE93A0P020130411>). Reuters. Retrieved 7 January 2014.
141. Lee, Timothy B. (4 November 2013). "Bitcoin Doesn't Have a Deflation Problem" (<http://www.forbes.com/sites/timothylee/2013/04/11/bitcoin-doesnt-have-a-deflation-problem/>). *Forbes*. Retrieved 27 January 2014.
142. Lee, Timothy B. (12 April 2013). "Bitcoin's Volatility Is A Disadvantage, But Not A Fatal One" (<http://www.forbes.com/sites/timothylee/2013/04/12/bitcoins-volatility-is-a-disadvantage-but-not-a-fatal-one/>). *Forbes*. Retrieved 15 November 2014.
143. Colombo, Jesse (19 December 2013). "Bitcoin May Be Following This Classic Bubble Stages Chart" (<http://www.forbes.com/sites/jessecolombo/2013/12/19/bitcoin-may-be-following-this-classic-bubble-stages-chart/>). *Forbes*. Retrieved 7 January 2014.
144. Moore, Heidi (3 April 2013). "Confused about Bitcoin? It's 'the Harlem Shake of currency' " (<http://www.theguardian.com/commentisfree/2013/apr/03/bitcoin-currency-bubble-crash-not-rocking-financial-markets>). *theguardian.com*. The Guardian. Retrieved 2 May 2014.
145. Lee, Timothy (5 November 2013). "When will the people who called Bitcoin a bubble admit they were wrong" (<http://www.washingtonpost.com/blogs/the-switch/wp/2013/11/05/when-will-the-people-who-called-bitcoin-a-bubble-admit-they-were-wrong>). The Washington Post. Retrieved 10 January 2014.
146. Liu, Alec (19 March 2013). "When Governments Take Your Money, Bitcoin Looks Really Good" (<http://motherboard.vice.com/blog/cyprus-spain-when-governments-take-your-money-bitcoin-looks-really-good>). Motherboard. Retrieved 7 January 2014.
147. Lee, Timothy B. (11 April 2013). "An Illustrated History Of Bitcoin Crashes" (<http://www.forbes.com/sites/timothylee/2013/04/11/an-illustrated-history-of-bitcoin-crashes/>). *Forbes*. Retrieved 7 January 2014.
148. Ben Rooney (29 November 2013). "Bitcoin worth almost as much as gold" (<http://money.cnn.com/2013/11/29/investing/bitcoin-gold/index.html>). CNN. Retrieved 31 October 2014.
149. "Bitcoin prices remain below \$600 amid bearish chart signals" (<http://www.nasdaq.com/article/bitcoin-prices-remain-below-600-amid-bearish-chart-signals-cm376685>). *nasdaq.com*. August 2014. Retrieved 31 October 2014.
150. Ember, Sydney (13 January 2015). "As Bitcoin's Price Slides, Signs of a Squeeze" (http://dealbook.nytimes.com/2015/01/13/as-bitcoins-price-slides-signs-of-a-squeeze/?_r=0). *New York Times*. Retrieved 16 January 2015.
151. Price, Rob (16 January 2015). "Deep Web Drug Dealers Are Freaking Out About The Bitcoin Crash" (<http://uk.businessinsider.com/bitcoin-crash-drug-dealers-2015-1?r=US>). *Business Insider*. Retrieved 18 January 2015.
152. Kearns, Jeff (4 December 2013). "Greenspan Says Bitcoin a Bubble Without Intrinsic Currency Value" (<http://www.bloomberg.com/news/2013-12-04/greenspan-says-bitcoin-a-bubble-without-intrinsic-currency-value.html>). *bloomberg.com* (Bloomberg LP). Retrieved 23 December 2013.
153. Quiggin, John (16 April 2013). "The Bitcoin Bubble and a Bad Hypothesis" (<http://nationalinterest.org/commentary/the-bitcoin-bubble-bad-hypothesis-8353>). *The National Interest*. Retrieved 31 October 2014.
154. Shiller, Robert (1 March 2014). "In Search of a Stable Electronic Currency" (http://www.nytimes.com/2014/03/02/business/in-search-of-a-stable-electronic-currency.html?_r=0). *New York Times*. Retrieved 31 October 2014.
155. Dan Caplinger (4 April 2013). "Bitcoin's History of Crushing Speculators" (<http://www.fool.com/retirement/general/2013/04/04/bitcoins-history-of-crushing-speculators.aspx>). The Motley Fool. Retrieved 7 January 2014.
156. Barford, Vanessa (13 December 2013). "Bitcoin: Price v hype" (<http://www.bbc.co.uk/news/magazine-25332746>). *bbc.com* (BBC). Retrieved 23 December 2013.
157. Boesler, Matthew (7 March 2013). "ANALYST: The Rise Of Bitcoin Teaches A Tremendous Lesson About Global Economics" (<http://www.businessinsider.com/global-economics-lesson-from-bitcoin-2013-3>). *Business Insider*. Retrieved 31 October 2014.
158. Posner, Eric (11 April 2013). "Bitcoin is a Ponzi scheme—the Internet's favorite currency will collapse." (http://www.slate.com/articles/news_and_politics/view_from_chicago/2013/04/bitcoin_is_a_ponzi_scheme_the_internet_currency_will_collapse.html). *Slate*. Retrieved 1 April 2014.
159. Clinch, Matt (10 March 2014). "Roubini launches stinging attack on bitcoin" (<http://www.cnbc.com/id/101479123>). *CNBC*. Retrieved 2 July 2014.
160. Ott Ummelas and Milda Seputyte (31 Jan 2014). "Bitcoin 'Ponzi' Concern Sparks Warning From Estonia Bank" (<http://www.bloomberg.com/news/2014-01-30/bitcoin-ponzi-scheme-worry-sparks-estonia-central-bank-caution.html>). *bloomberg.com* (Bloomberg). Retrieved 1 April 2014.
161. European Central Bank (October 2012). *Virtual Currency Schemes* (<http://www.ecb.europa.eu/pub/pdf/other/virtualcurrencyschemes201210en.pdf>) (PDF). Frankfurt am Main: European Central Bank. ISBN 978-92-899-0862-7. Retrieved 5 March 2014.
162. Kaushik Basu (July 2014). "Ponzis: The Science and Mystique of a Class of Financial Frauds" (http://www-wds.worldbank.org/external/default/WDSContentServer/WDSP/IB/2014/07/16/000112742_20140716115536/Rendered/PDF/WPS6967.pdf) (PDF). World Bank Group. Retrieved 30 October 2014.
163. Lubin, Gus (9 March 2014). "ROUBINI: 'Bitcoin Is A Ponzi Game And A Conduit For Criminal Activities'" (<http://www.businessinsider.com/roubini-bitcoin-is-a-ponzi-scheme-and-a-conduit-for-criminal-activities-2014-3>). *Business Insider*. Retrieved 1 April 2014.
164. Jonathon M. Trugman (15 February 2014). "Welcome to 21st-century Ponzi scheme: Bitcoin" (<http://nypost.com/2014/02/15/welcome-to-21st-century-ponzi-scheme-bitcoin/>). *The New York Post* (NYP Holdings, inc.). Retrieved 13 December 2014.
165. Jim Gibson (21 April 2014). "Is Bitcoin a Ponzi Scheme" (http://www.huffingtonpost.com/jim-gibson/is-bitcoin-a-ponzi-scheme_b_5177769.html). *Huffington Post* (TheHuffingtonPost.com, Inc.). Retrieved 21 November 2014.
166. Jeremy Kirk (18 December 2013). "Bitcoin: The virtual currency built on math, hope and hype" (<http://www.pcworld.com/article/2081560/bitcoin-the-virtual-currency-built-on-math-hope-and-hype.html>). *PC World* (International Data Group). Retrieved 21 November 2014.
167. Tucker, Jeffrey (1 December 2013). "Ponzi Logic: Debunking Gary North" (<http://libertarianstandard.com/2013/12/01/ponzi-logic-debunking-gary-north/>). *The Libertarian Standard*. Retrieved 12 Feb 2014.
168. "Federal Council report on virtual currencies in response to the Schwaab (13.3687) and Weibel (13.4070) postulates" (<http://www.news.admin.ch/NSBSubscriber/message/attachments/35355.pdf>) (PDF). *Federal Council (Switzerland)*. Swiss Confederation. 25 June 2014. Retrieved 28 November 2014.
169. Kevin Dowd (5 November 2014). "Bitcoin is bust: Why investors should abandon the doomed cryptocurrency" (<http://www.cityam.com/1415215686/bitcoin-bust-why-investors-should-abandon-doomed-cryptocurrency>). *Opinion* (City A.M.). Retrieved 6 November 2014.
170. Eoghan Macguire (14 November 2014). "Bitcoin: One year on from peak price, what does the future hold?" (<http://www.cnn.com/2014/11/13/tech/bitcoin-peak-price-future>). *Future Finance*. CNN. Retrieved 15 November 2014.
171. Williams, Mark T. (17 December 2013). "FINANCE PROFESSOR: Bitcoin Will Crash To \$10 By Mid-2014" (<http://www.businessinsider.com/williams-bitcoin-meltdown-10-2013-12>). *businessinsider.com*. *Business Insider*. Retrieved 26 February 2014.
172. Steve H. Hanke (18 September 2014). "Bitcoin Charts, Finally" (http://www.huffingtonpost.com/steve-h-hanke/bitcoin-charts_b_5838132.html). *Huffington Post* (TheHuffingtonPost.com, Inc.). Retrieved 21 November 2014.
173. Robin Sidel (1 December 2014). "How Mt. Gox Debacle Won Over a Bitcoin Convert" (<http://online.wsj.com/articles/how-mt-gox-debacle-won-over-a-bitcoin-convert-1417471759>). *Markets* (The Wall Street Journal). Retrieved 4 December 2014.
174. Sharf, Samantha (12 May 2013). "Bitcoin Gets Valued: Bank Of America Puts A Price Target On The Virtual Tender" (<http://www.forbes.com/sites/samanthasharf/2013/12/05/bitcoin-gets-valued-bank-of-america-puts-a-price-on-the-virtual-tender/>). *Forbes* (New York). Retrieved 31 October 2014.
175. Schroeder, Stan (1 December 2013). "Cameron Winklevoss: Bitcoin Might Hit \$40,000 Per Coin" (<http://mashable.com/2013/12/16/cameron-winklevoss-bitcoin/>). *Mashable* (New York). Retrieved 31 October 2014.
176. Everett Rosenfeld (14 Jan 2015) "Bitcoin keeps falling, and worries keep rising" (<http://www.cnbc.com/id/102337172#>). *CNBC*. Retrieved 24 January 2015.

176. Evelyn Roseberg (17 Jan 2015). "Bitcoin keeps falling, and worries keep rising" (<http://www.cnn.com/2015/01/17/tech/bitcoin/>). CNN. Retrieved 27 January 2015.
177. Worstall, Tim (20 June 2011). "So, That's the End of Bitcoin Then" (<http://www.forbes.com/sites/timworstall/2011/06/20/so-thats-the-end-of-bitcoin-then/>). *Forbes*. Retrieved 18 January 2015.
178. Covert, Adrian (9 August 2011). "The Bitcoin Is Dying. Whatever." (<http://www.gizmodo.com.au/2011/08/the-bitcoin-is-dying-whatever/>). *Gizmodo Australia* (Allure Media). Retrieved 18 January 2015.
179. Calore, Michael (24 December 2012). "Wired, Tired, Expired for 2012: From Stellar to Suck" (<http://www.wired.com/2012/12/wired-tired-expired/#slideid-331231>). *Wired* (Condé Nast). Retrieved 18 January 2015.
180. Jourdan, Stanislas (21 May 2013). "Game over, bitcoin. Where is the next human-based digital currency?" (<http://magazine.ouishare.net/2013/05/bitcoin-human-based-digital-currency/>). *Ouishare Magazine*. Retrieved 18 January 2015.
181. Roose, Kevin (20 June 2013). "Bitcoin Sees the Grim Reaper" (<http://nymag.com/daily/intelligencer/2013/06/bitcoin-sees-the-grim-reaper.html>). *New York Magazine* (New York Media LLC). Retrieved 18 January 2015.
182. Hadas, Edward (8 January 2014). "An early obituary for bitcoin" (<http://blogs.reuters.com/edward-hadas/2014/01/08/an-early-obituary-for-bitcoin/>). Reuters. Retrieved 18 January 2015.
183. "Bitcoin is Dead" (<http://www.streetinsider.com/Analyst+Comments/Bitcoin+is+Dead/9219338.html>). Streetinsider.com. 26 February 2014. Retrieved 18 January 2015.
184. Last, Jonathan V. (5 March 2014). "Bitcoin Is Dead" (http://www.weeklystandard.com/blogs/bitcoin-dead_784187.html). *The Weekly Standard* (The Weekly Standard LLC). Retrieved 18 January 2015.
185. Leonard, Andrew (7 March 2014). "Sorry, libertarians: Your dream of a Bitcoin paradise is officially dead and gone" (http://www.salon.com/2014/03/07/sorry_libertarians_your_dream_of_a_bitcoin_paradise_is_officially_dead_and_gone/). *Salon* (Salon Media Group Inc.). Retrieved 18 January 2015.
186. Owen, Taylor (24 March 2014). "Bitcoin Is Dead — Long Live Bitcoin" (<https://news.vice.com/article/bitcoin-is-dead-long-live-bitcoin>). *Vice News*. Retrieved 18 January 2015.
187. Kaminska, Izabella (19 September 2014). "Cult Markets: When the bubble bursts" (<http://ftalphaville.ft.com/2014/09/19/1976132/cult-markets-when-the-bubble-bursts>). *Financial Times*.
188. Krantz, Matt (16 January 2015). "Bitcoin is headed to the 'ash heap'" (<http://americasmarkets.usatoday.com/2015/01/16/bitcoin-is-headed-to-the-ash-heap/>). *USA Today*. Retrieved 18 January 2015.
189. Sparkes, Matthew (15 January 2015). "Bitcoin might be dead. It doesn't matter." (<http://www.telegraph.co.uk/technology/news/11347205/Bitcoin-might-be-dead-It-doesnt-matter..html>). *The Telegraph*. Retrieved 18 January 2015.
190. Greenhill, Peter. "Reports of Bitcoin's Death Have Been Greatly Exaggerated" (http://www.huffingtonpost.co.uk/peter-greenhill/decline-of-bitcoin_b_6976474.html). Retrieved 5 April 2015.
191. Velde, François (December 2013). "Bitcoin: A primer" (https://www.chicagofed.org/digital_assets/publications/chicago_fed_letter/2013/cfldecember2013_317.pdf) (PDF). *Chicago Fed letter* (317). Federal Reserve Bank of Chicago. p. 4. Retrieved December 2013.
192. Metz, Cade (10 February 2014). "Meet Patrick Byrne: Bitcoin Messiah, CEO of Overstock, Scourge of Wall Street" (<http://www.wired.com/2014/02/rise-fall-rise-patrick-byrne/>). *Wired*. Wired. Retrieved 16 July 2014.
193. Paul Krugman (28 December 2013). "Bitcoin Is Evil" (<http://krugman.blogs.nytimes.com/2013/12/28/bitcoin-is-evil/>). *krugman.blogs.nytimes.com*. Retrieved 28 December 2013.
194. Wile, Rob (6 April 2014). "St. Louis Fed Economist: Bitcoin Could Be A Good Threat To Central Banks" (<http://www.businessinsider.com/interview-with-david-andolfatto-2014-4>). *businessinsider.com*. Business Insider. Retrieved 16 April 2014.
195. Andolfatto, David (24 December 2013). "In gold we trust?" (<http://andolfatto.blogspot.com/2013/12/in-gold-we-trust.html>). *MacroMania*. David Andolfatto. Retrieved 17 April 2014. "Also, note that I am not against gold or bitcoin (or whatever) as a currency. In fact, I think that the threat that they pose as alternate currency can serve as a useful check on a central bank."
196. Sparkes, Matthew (2 December 2013). "Software activist calls for 'truly anonymous' Bitcoins to 'protect democracy'" (<http://www.telegraph.co.uk/technology/news/10488201/Software-activist-calls-for-truly-anonymous-Bitcoins-to-protect-democracy.html>). London: Telegraph. Retrieved 27 December 2013.
197. Shankland, Stephen (10 December 2013). "PayPal president David Marcus: Bitcoin is good, NFC is bad" (http://news.cnet.com/8301-1023_3-57615080-93/paypal-president-david-marcus-bitcoin-is-good-nfc-is-bad/). *CNET*. Retrieved 10 December 2013.
198. "Bill Gates: Bitcoin Is Exciting Because It's Cheap" (<http://www.bloomberg.com/video/bill-gates-bitcoin-is-exciting-because-it-s-cheap-dQ4qHV4~TLsnUfRfZBVA.html>). Bloomberg L.P. 2 October 2014. Retrieved 12 November 2014.
199. Kyle Torpey (21 May 2014). "Peter Schiff Embraces Bitcoin at Euro Pacific Precious Metals" (<https://www.cryptocoinsnews.com/peter-schiff-embraces-bitcoin-euro-pacific-precious-metals/>). *CryptoCoinsNews*. Retrieved 12 December 2014.
200. "Alternatives to Central Banking: Toward Free-Market Money" (<http://www.cato.org/events/32nd-annual-monetary-conference>). Cato Institute. 6 November 2014. Retrieved 13 December 2014.
201. "Clearly Canadian Joins Bitcoin Community" (<http://finance.yahoo.com/news/clearly-canadian-joins-bitcoin-community-110000013.html>). *finance.yahoo.com*. Yahoo! Finance. 23 December 2013. Retrieved 10 February 2014.
202. Sydney Ember (18 July 2014). "Dell Begins Accepting Bitcoin" (<http://dealbook.nytimes.com/2014/07/18/dell-begins-accepting-bitcoin/>). *New York Times*. Retrieved 18 July 2014.
203. Casey, Michael (May 29, 2014). "Dish Network to Accept Bitcoin Payments" (<http://www.wsj.com/articles/dish-network-to-accept-bitcoin-payments-1401363621>). *The Wall Street Journal*. Dow Jones & Company. Retrieved 15 February 2015.
204. Mat 'Inferiorego' Elfring (17 September 2014). "Dynamite Digital Adds Bitcoin Payment Option and Offers Discount Bundle" (<http://www.comicvine.com/articles/dynamite-digital-adds-bitcoin-payment-option-and-o/1100-149863/>). CBS Interactive. Retrieved 27 December 2014.
205. Paul Vigna (11 June 2014). "Expedia Starts Accepting Bitcoin for Hotel Bookings" (<http://blogs.wsj.com/moneybeat/2014/06/11/expedia-starts-accepting-bitcoin-for-hotel-bookings/>). *Money Beat*. The Wall Street Journal. Retrieved 27 July 2014.
206. "Newegg accepts bitcoins" (<http://www.newegg.com/bitcoin>). *newegg.com*. 1 July 2014. Retrieved 3 July 2014.
207. Sparkes, Matthew (10 January 2014). "Ten places where you can spend your bitcoins in the UK" (<http://www.telegraph.co.uk/technology/news/10558191/Ten-places-where-you-can-spend-your-bitcoins-in-the-UK.html>). *The Telegraph*. Retrieved 10 September 2013.
208. Davidson, Kavitha (16 Jan 2014). "How Many Bitcoins for a Courtside Seat?" (<http://www.bloomberg.com/news/2014-01-16/how-many-bitcoins-for-a-courtside-seat-.html>). *bloomberg.com* (Bloomberg LP). Retrieved 20 January 2014.
209. Ember, Sydney (16 December 2014). "Time Inc. begins accepting bitcoin payments" (http://dealbook.nytimes.com/2014/12/16/time-inc-begins-accepting-bitcoin-payments/?_r=1). *Dealbook*. The New York Times. Retrieved 9 January 2015.
210. Holpuch, Amanda (22 November 2013). "Virgin Galactic to accept Bitcoin for space flights" (<http://www.theguardian.com/technology/2013/nov/22/virgin-galactic-bitcoin-space-flights-payment>). *The Guardian*. Retrieved 24 November 2013.
211. Kharif, Olga (6 Jan 2014). "Bitcoin Tops \$1,000 Again as Zynga Accepts Virtual Money" (<http://www.bloomberg.com/news/2014-01-05/bitcoin-tops-1-000-again-on-adoption-by-zynga-amid-wider-usage.html>). *bloomberg.com* (Bloomberg LP). Retrieved 20 January 2014.
212. Stephanie Lo and J. Christina Wang (September 2014). "Bitcoin as Money?" (<http://www.bostonfed.org/economic/current-policy-perspectives/2014/cpp1404.pdf>) (PDF). *Current Policy Perspectives (Federal Reserve Bank of Boston)* **14** (1): 6.
213. Scott Ellison (23 September 2014). "PayPal and Virtual Currency" (<https://www.paypal-community.com/t5/PayPal-Forward/PayPal-and-Virtual-Currency/ba-p/828230>). PayPal. Retrieved 31 October 2014.
214. Cassidy Sharp (22 September 2014). "Greenpeace now accepting bitcoin donations" (<http://greenpeaceblogs.org/2014/09/22/greenpeace-now-accepting-bitcoin-donations/>). Greenpeace. Retrieved 31 October 2014.
215. Emil Protalinski (21 November 2014). "Mozilla's 2013 annual report: Revenue up just 1% to \$314M, and again 90% came from Google" (<http://venturebeat.com/2014/11/21/mozilla-releases-annual-report-for-2013-revenue-up-just-1-to-314m-and-again-90-came-from-google/>). Retrieved 8 January 2015.
216. Lisa Gruwell (30 July 2014). "Wikimedia Foundation Now Accepts Bitcoin" (<http://blog.wikimedia.org/2014/07/30/wikimedia-foundation-now-accepts-bitcoin/>). Retrieved 10 August 2014.

- bitcom/). Wikimedia. Retrieved 30 October 2014.
217. Jaime Fuller (16 June 2014). "Bring the popcorn — here's our guide to the hottest primaries of the summer" (<http://www.washingtonpost.com/blogs/the-fix/wp/2014/06/16/bring-the-popcorn-heres-our-guide-to-the-hottest-primaries-of-the-summer/>). Washington Post. Retrieved 8 January 2015.
218. Vigna, Paul (22 November 2013). "The University of Bitcoin Rises in Cyprus" (<http://blogs.wsj.com/moneybeat/2013/11/22/the-university-of-bitcoin-rises-in-cyprus/>). *The Wall Street Journal*. Retrieved 22 November 2013.
219. GERTRUDE CHAVEZ-DREYFUSS AND MICHAEL CONNOR (11 Dec 2014). "All the rage a year ago, bitcoin sputters as adoption stalls" (http://www.reuters.com/article/2014/12/11/us-markets-bitcoin-adoption-analysis-idUSKBN0JP2CZ20141211?utm_source=Triggermail&utm_medium=email&utm_term=BII%20List%20Payments%20ALL&utm_campaign=Post%20Blast%20%28bii-payments%29%3A%20Alibaba%20launches%20internet%20bank%20%E2%80%93%20JD.com%20offering%20installment%20loans%20%E2%80%93%20Millennials%20have%20mixed%20reactions%20about%20Bitcoin). *reuters.com*. Thompson Reuters. Retrieved 30 June 2015. "bitcoin."
220. Robin Sidel (22 December 2013). "Banks Mostly Avoid Providing Bitcoin Services" (<http://www.wsj.com/articles/SB10001424052702304202204579252850121034702>). Wallstreet Journal. Retrieved 27 December 2014.
221. Dougherty, Carter (5 December 2013). "Bankers Balking at Bitcoin in U.S. as Real-World Obstacles Mount" (<http://www.bloomberg.com/news/2013-12-05/bitcoin-skepticism-by-bankers-from-china-to-u-s-hinders-growth.html>). *bloomberg.com*. Bloomberg. Retrieved 16 April 2014.
222. "Bitcoin firms dumped by National Australia Bank as 'too risky'" (<http://www.theguardian.com/world/2014/apr/10/bitcoin-dumped-by-national-australia-bank-as-too-risky>). *Australian Associated Press*. The Guardian. 10 April 2014. Retrieved 23 February 2015.
223. Weir, Mike (1 December 2014). "HSBC severs links with firm behind Bitcoin fund" (<http://www.bbc.com/news/world-europe-jersey-30261976>). *bbc.com*. BBC. Retrieved 9 January 2015.
224. Hill, Kashmir (5 December 2013). "Bitcoin Valued At \$1300 By Bank of America Analysts" (<http://www.forbes.com/sites/kashmirhill/2013/12/05/bank-of-america-analysts-say-bitcoins-value-is-1300/>). *Forbes.com*. Retrieved 23 March 2014.
225. "Bitcoin: is Circle the world's first crypto-currency bank?" (<http://www.theweek.co.uk/world-news/bitcoin/56138/bitcoin-passes-1000-mark-will-it-take-over-world>). *The week.co.uk*. 16 May 2014. Retrieved 13 June 2014.
226. Salyer, Kirsten (20 March 2013). "Fleeing the Euro for Bitcoins" (<http://www.bloomberg.com/news/2013-03-20/fleeing-the-euro-for-bitcoins-.html>). Bloomberg L.P. Retrieved 31 October 2014.
227. "Jersey approve Bitcoin fund launch on island" (<http://www.bbc.com/news/world-europe-jersey-28247796>). BBC news. 10 July 2014. Retrieved 10 July 2014.
228. Nathaniel Popper and Peter Lattman (11 April 2013). "Never Mind Facebook; Winklevoss Twins Rule in Digital Money" (<http://dealbook.nytimes.com/2013/04/11/as-big-investors-emerge-bitcoin-gets-ready-for-its-close-up/>). The New York Times. Retrieved 31 October 2014.
229. Grocer, Stephen (2 July 2013). "Beware the Risks of the Bitcoin: Winklevii Outline the Downside" (<http://blogs.wsj.com/moneybeat/2013/07/02/beware-the-risks-of-the-bitcoin-winklevii-outline-the-downside/>). *Moneybeat* (The Wall Street Journal). Retrieved 21 October 2013.
230. Popper, N. and Ember, S. (23 Jan 2015). "Winklevoss Twins aim to take Bitcoin Mainstream" (http://dealbook.nytimes.com/2015/01/22/winklevoss-twins-aim-to-take-bitcoin-mainstream-with-a-regulated-exchange/?_r=0). *Dealbook blog*. The New York Times. Retrieved 15 February 2015.
231. Jonathan Stempel (11 March 2014). "Beware Bitcoin: U.S. brokerage regulator." (<http://www.reuters.com/article/2014/03/11/us-bitcoin-finra-idUSBREA2A1OJ20140311>). *reuters.com*. Retrieved 14 March 2014.
232. Steverman, Ben (Dec 23, 2014). "The Best and Worst Investments of 2014" (<http://www.bloomberg.com/news/2014-12-22/the-best-and-worst-investments-of-2014.html>). *bloomberg.com*. Bloomberg LP. Retrieved 9 January 2015.
233. Hill, Kashmir. "How You Should Have Spent \$100 In 2013 (Hint: Bitcoin)" (<http://www.forbes.com/sites/kashmirhill/2013/12/26/how-you-should-have-spent-100-in-2013-hint-bitcoin/>). Retrieved 16 Feb 2015.
234. "NYSE to Launch NYSE Bitcoin Index, NYXBT" (<http://www.businesswire.com/news/home/20150519005701/en#.VV-cNkhM6HD>). *businesswire.com*. Business Wire. May 19, 2015. Retrieved 22 May 2015.
235. Simonite, Tom (12 June 2013). "Bitcoin Millionaires Become Investing Angels" (<http://www.technologyreview.com/news/515391/bitcoin-millionaires-become-investing-angels/>). *Computing News* (MIT Technology Review). Retrieved 13 June 2013.
236. Robin Sidel (1 December 2014). "Ten-hut! Bitcoin Recruits Snap To" (<http://www.wsj.com/news/articles/SB21659981523255993497704580305120918936264?mg=reno64-wsj&url=http%3A%2F%2Fonline.wsj.com%2Farticle%2FSB21659981523255993497704580305120918936264.html>). *Wall Street Journal* (Dow Jones & Company). Retrieved 9 December 2014.
237. Alex Hern (1 July 2014). "Silk Road's legacy 30,000 bitcoin sold at auction to mystery buyers" (<http://www.theguardian.com/technology/2014/jul/01/silk-road-bitcoin-auction>). The Guardian. Retrieved 31 October 2014.
238. "CoinSeed raises \$7.5m, invests \$5m in Bitcoin mining hardware – Investment Round Up" (<http://www.redherring.com/finance/coinseed-raises-7-5m-invests-5m-in-bitcoin-mining-hardware-investment-round-up/>). *Red Herring*. 24 January 2014. Retrieved 9 March 2014.
239. Doug Henwood (19 May 2014). "Bitcoin the Future of Money?" (<http://www.thenation.com/article/179620/bitcoin-future-money?page=full>). The Nation.com. Retrieved 12 September 2014.
240. Matthew Graham Wilson and Aaron Yelowitz (November 2014). "Characteristics of Bitcoin Users: An Analysis of Google Search Data" (http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2518603). *Social Science Research Network*. Working Papers Series.
241. Brett Scott (1 June 2014). "Visions of a Techno-Leviathan: The Politics of the Bitcoin Blockchain" (<http://www.e-ir.info/2014/06/01/visions-of-a-techno-leviathan-the-politics-of-the-bitcoin-blockchain/>). E-International Relations. Retrieved 31 October 2014.
242. Margaret Corvid (December 2013). "A left defence of Bitcoin" (<http://internationalsocialistnetwork.org/index.php/ideas-and-arguments/301-mistress-magpie-a-left-defence-of-bitcoin>). International Socialist Network. Retrieved 31 October 2014.
243. Melanie L. Fein (15 February 2013). "The Shadow Banking Charade" (<http://ssrn.com/abstract=2218812>). Retrieved 31 October 2014.
244. Edward Hadas (27 November 2013). "Right-wing dreams" (<http://www.breakingviews.com/edward-hadas-bitcoin-is-a-step-back-not-forward/21121998.article>). Thomson Reuters. Retrieved 31 October 2014.
245. Hamill, Jasper (19 December 2013). "Native American Activist Wants To Swap The Dollar For Bitcoin" (<http://www.forbes.com/sites/jasperhamill/2013/12/19/native-american-activist-wants-to-swap-the-dollar-for-bitcoin/>). *Forbes*. Retrieved 1 October 2014.
246. Staff (10 January 2015). "Much more than digital cash" (<http://www.economist.com/news/business-books-quarterly/21638093-rise-and-fall-crypto-currency-good-news-authors-least-much>). *The Economist* (The Economist Newspaper Ltd). Retrieved 13 January 2015.
247. Strauss, Steven (14 April 2013). "Nine Trust-Based Problems With Bitcoin" (http://www.huffingtonpost.com/steven-strauss/bitcoin_b_3081812.html). *The Huffington Post*. Retrieved 20 October 2013.
248. AFP (15 Sep 2014). "Why Bangladesh will jail Bitcoin traders" (<http://www.telegraph.co.uk/finance/currency/11097208/Why-Bangladesh-will-jail-Bitcoin-traders.html>). *telegraph.co.uk*. The Telegraph. Retrieved 23 February 2015.
249. Cuthbertson, Anthony (20 June 2014). "Cryptocurrency Round-Up: Bolivian Bitcoin Ban, iOS Apps & Dogecoin at McDonald's" (<http://www.ibtimes.co.uk/cryptocurrency-round-bolivian-bitcoin-ban-ios-apps-dogecoin-mcdonalds-1453453>). *ibtimes.co.uk*. International Business Times. Retrieved 23 February 2015.
250. Cuthbertson, Anthony (1 September 2014). "Ecuador Reveals National Digital Currency Plans Following Bitcoin Ban" (<http://www.ibtimes.co.uk/ecuador-reveals-national-digital-currency-plans-following-bitcoin-ban-1463397>). *ibtimes.co.uk*. International Business Times. Retrieved 23 February 2015.
251. Szczepeński, Marcin (November 2014). "Bitcoin: Market, economics and regulation" ([http://www.europarl.europa.eu/RegData/bibliotheque/briefing/2014/140793/LDM_BRI\(2014\)140793_REV1_EN.pdf](http://www.europarl.europa.eu/RegData/bibliotheque/briefing/2014/140793/LDM_BRI(2014)140793_REV1_EN.pdf)) (PDF). *European Parliamentary Research Service*. Annex B: Bitcoin regulation or plans therefor in selected countries. Members' Research Service. p. 9. Retrieved 18 February 2015.
252. "Vietnam says bitcoin transactions are illegal" (<http://news.yahoo.com/vietnam-says-bitcoin-transactions-illegal-043314375.html>). *AP*. Yahoo! News. 28 February 2014. Retrieved 23 February 2015.
253. Sanati, Cyrus (18 December 2012). "Bitcoin looks primed for money laundering" (<http://finance.fortune.cnn.com/2012/12/18/bitcoin-money-laundering/>). *money.cnn.com* (CNN). Retrieved 18 October 2013.
254. "Monetarists Anonymous" (<http://www.economist.com/node/21563752>). *The Economist* (The Economist Newspaper Limited). 29 September 2012. Retrieved 21 October 2013.
255. Ball, James (22 March 2013). "Silk Road: the online drug marketplace that officials seem powerless to stop" (<http://www.theguardian.com/world/2013/mar/22/silk-road-online-drug-marketplace>). *theguardian.com*. Guardian News and Media Limited. Retrieved

- 20 October 2013.
256. Jeffries, Adrienne (19 December 2013). "How to steal Bitcoin in three easy steps" (<http://www.theverge.com/2013/12/19/5183356/how-to-steal-bitcoin-in-three-easy-steps>). *The Verge*. Retrieved 17 January 2014.
257. Everett, David (April 2012). "So how can you steal Bitcoins" (http://www.smartcard.co.uk/articles/so_how_can_you_steal_bitcoins.php). *Smartcard & Identity News*. Retrieved 17 January 2014.
258. Hern, Alex (9 December 2013). "Recovering stolen bitcoin: a digital wild goose chase" (<http://www.theguardian.com/technology/2013/dec/09/recovering-stolen-bitcoin-sheep-marketplace-trading-digital-currency-money>). *The Guardian*. Retrieved 6 March 2014.
259. "Silk Road 2 loses \$2.7m in bitcoins in alleged hack" (<http://www.bbc.co.uk/news/technology-26187725>). *BBC News*. 14 February 2014. Retrieved 15 February 2014.
260. "Bitcoin site Inputs.io loses £1m after hackers strike twice" (<http://www.theguardian.com/technology/2013/nov/08/hackers-steal-1m-from-bitcoin-trade-fortress-site>).
261. Ligaya, Armina (5 March 2014). "After Alberta's Flexcoin, Mt. Gox hacked, Bitcoin businesses face sting of free-wheeling ways" (<http://business.financialpost.com/2014/03/05/after-albertas-flexcoin-mt-gox-hacked-bitcoin-businesses-face-sting-of-free-wheeling-ways/>). *Financial Post*. Retrieved 7 March 2014.
262. Truong, Alice (6 March 2014). "Another Bitcoin exchange, another heist" (<http://www.fastcompany.com/3027373/fast-feed/another-bitcoin-exchange-another-heist>). *Fast Company*. Retrieved 7 March 2014.
263. Zack Whittaker (5 January 2015). "Bitstamp exchange hacked, \$5M worth of bitcoin stolen" (<http://www.zdnet.com/article/bitstamp-bitcoin-exchange-suspended-amid-hack-concerns-heres-what-we-know/>). *Zdnet*. CBS Interactive. Retrieved 6 January 2015.
264. Millward, Steven (Feb 16, 2015). "Nearly \$2M in bitcoins feared lost after Chinese cryptocurrency exchange hack" (<https://www.techinasia.com/bitcoins-lost-after-china-cryptocurrency-exchange-hack-bter/>). *techinasia.com*. Tech In Asia. Retrieved 18 February 2015.
265. Christin, Nicolas (2013). *Traveling the Silk Road: A Measurement Analysis of a Large Anonymous Online Marketplace* (<http://www.andrew.cmu.edu/user/nicolasc/publications/Christin-WWW13.pdf>) (PDF). Carnegie Mellon INI/CyLab. p. 8. Retrieved 22 October 2013. "we suggest to compare the estimated total volume of Silk Road transactions with the estimated total volume of transactions at all Bitcoin exchanges (including Mt.Gox, but not limited to it). The latter corresponds to the amount of money entering and leaving the Bitcoin network, and statistics for it are readily available... approximately 1,335,580 BTC were exchanged on Silk Road... approximately 29,553,384 BTC were traded in Bitcoin exchanges over the same period... The only conclusion we can draw from this comparison is that Silk Road-related trades could plausibly correspond to 4.5% to 9% of all exchange trades"
266. Schweizer, Kristen (10 October 2014). "Bitcoin Payments by Pedophiles Frustrate Child Porn Fight" (<http://www.bloomberg.com/news/articles/2014-10-09/bitcoin-payments-by-pedophiles-frustrate-child-porn-fight>). *BloombergBusiness*. Bloomberg LP. Retrieved 16 February 2015.
267. Lake, Eli (17 October 2013). "Hitman Network Says It Accepts Bitcoins to Murder for Hire" (<http://www.thedailybeast.com/articles/2013/10/17/hitman-network-says-it-accepts-bitcoins-to-murder-for-hire.html>). *The Daily Beast*. The Daily Beast Company LLC. Retrieved 17 February 2015.
268. Smith, Gerry (15 April 2013). "How Bitcoin Sales Of Guns Could Undermine New Rules" (http://www.huffingtonpost.com/2013/04/15/bitcoin-guns_n_3070828.html). *huffingtonpost.com* (TheHuffingtonPost.com, Inc.). Retrieved 20 October 2013.
269. Andy Greenberg (23 October 2013). "FBI Says It's Seized \$28.5 Million In Bitcoins From Ross Ulbricht, Alleged Owner Of Silk Road" (<http://www.forbes.com/sites/andygreenberg/2013/10/25/fbi-says-its-seized-20-million-in-bitcoins-from-ross-ulbricht-alleged-owner-of-silk-road/>) (blog). *Forbes.com*. Retrieved 24 November 2013.
270. Kelion, Leo (12 February 2014). "Five arrested in Utopia dark net marketplace crackdown" (<http://www.bbc.co.uk/news/technology-26158012>). *bbc.co.uk* (BBC). Retrieved 13 February 2014.
271. Alex Hern (3 October 2013). "Bitcoin price plummets after Silk Road closure" (<http://www.theguardian.com/technology/2013/oct/03/bitcoin-price-silk-road-ulbricht-value>). *The Guardian*. Retrieved 31 October 2014. "Digital currency loses quarter of value after arrest of Ross Ulbricht, who is accused of running online drugs marketplace"
272. Robert McMillan (2 October 2013). "Bitcoin Values Plummet \$500M, Then Recover, After Silk Road Bust" (<http://www.wired.com/2013/10/bitcoin-market-drops-600-million-on-silk-road-bust/>). *Wired*. Retrieved 31 October 2014.
273. "Silk Road drug website founder Ross Ulbricht jailed" (<http://www.bbc.com/news/world-us-canada-32941060>). *BBC News*. BBC. 29 May 2015. Retrieved 30 May 2015.
274. Katie Silver (31 March 2014). "Silk Road closure fails to dampen illegal drug sales online, experts say" (<http://www.abc.net.au/news/2014-03-31/online-drug-trade-soaring-experts-say/5354930>). *ABC News*. Retrieved 31 October 2014.
275. Sophie Murray-Morris (13 February 2014). "Utopia no more: Drug marketplace seen as the next Silk Road shut down by Dutch police" (<http://www.independent.co.uk/life-style/gadgets-and-tech/utopia-no-more-drug-marketplace-seen-as-the-next-silk-road-shut-down-by-dutch-police-9126063.html>). *The Independent*. independent.co.uk. Retrieved 8 November 2014.
276. Wakefield, Jane (7 November 2014). "Huge raid to shut down 400-plus dark net sites" (<http://www.bbc.com/news/technology-29950946>). *bbc.com*. BBC. Retrieved 8 November 2014.
277. Nate Raymond (19 December 2014). "Bitcoin backer gets two years prison for illicit transfers" (<http://www.reuters.com/article/2014/12/19/us-usa-crime-bitcoin-idUSKBN0JX2CW20141219>). *Reuters* (Thompson Reuters). Retrieved 20 December 2014.
278. "Ross Ulbricht: Silk Road creator convicted on drugs charges" (<http://www.bbc.com/news/world-us-canada-31134938>). *BBC*. 5 February 2015. Retrieved 17 February 2015.
279. Ravi Mandalia (1 December 2013). "Silk Road-like Sheep Marketplace scams users; over 39k Bitcoins worth \$40 million stolen" (<http://www.techienews.co.uk/973470/silk-road-like-sheep-marketplace-scams-users-39k-bitcoins-worth-40-million-stolen/>). *Techie News*. Retrieved 2 December 2013.
280. "While Markets Get Seized: Pedophiles Launch a Crowdfunding Site" (<http://www.deepdotweb.com/2014/11/09/as-drug-markets-are-seized-pedophiles-launch-a-crowdfunding-site/>). Retrieved 19 Feb 2015.
281. Hopkins, Curt (7 May 2013). "If you own Bitcoin, you also own links to child porn" (<http://www.dailydot.com/business/bitcoin-child-porn-transaction-code/>). *The Daily Dot*. Retrieved 16 February 2015.
282. Bradbury, Danny. "As Bitcoin slides, the Blockchain grows" (<http://eandt.theiet.org/magazine/2015/02/in-blocks-we-trust.cfm>). *IET Engineering and Technology Magazine*.
283. Kirk, Jeremy (28 August 2013). "Bitcoin offers privacy-as long as you don't cash out or spend it" (<http://www.pcworld.com/article/2047608/bitcoin-offers-privacy-as-long-as-you-dont-cash-out-or-spend-it.html>). *PC World*. Retrieved 31 October 2014.
284. "Guidance for a Risk-Based Approach: Prepaid Cards, Mobile Payments and Internet-based Payment Services" (<http://www.fatf-gafi.org/media/fatf/documents/recommendations/Guidance-RBA-NPPS.pdf>) (PDF). *Guidance for a risk-based approach*. Paris: Financial Action Task Force (FATF). June 2013. p. 47. Retrieved 6 March 2014.
285. "SEC charges Texas man with running Bitcoin-denominated Ponzi scheme" (<https://www.sec.gov/News/PressRelease/Detail/PressRelease/1370539730583>) (Press release) (2013-132). US Securities and Exchange Commission. 23 July 2013. Retrieved 7 March 2014.
286. Jay Adkisson (25 September 2014). "Bitcoin Savings & Trust Comes Up \$40 Million Short On The Trust Part" (<http://www.forbes.com/sites/jayadkisson/2014/09/25/bitcoin-savings-trust-comes-up-40-million-short-on-the-trust-part/>). *Personal Finance* (Forbes). Retrieved 13 December 2014.
287. Greenburg, Andy (26 April 2014). "Nearly 150 Breeds Of Bitcoin-Stealing Malware In The Wild, Researchers Say" (<http://www.forbes.com/sites/andygreenberg/2014/02/26/nearly-150-breeds-of-bitcoin-stealing-malware-in-the-wild-researchers-say/>). *forbes.com*. Forbes. Retrieved 9 January 2015.
288. Peter Coogan (17 June 2011). "Bitcoin Botnet Mining" (<http://www.symantec.com/connect/blogs/bitcoin-botnet-mining>). *Symantec.com*. Retrieved 24 January 2012.
289. Goodin, Dan (16 August 2011). "Malware mints virtual currency using victim's GPU" (http://www.theregister.co.uk/2011/08/16/gpu_bitcoin_brute_forcing/). *The Register*. Retrieved 31 October 2014.
290. "Yahoo malware turned Euro PCs into bitcoin miners" (<http://www.slashgear.com/yahoo-malware-turned-euro-pcs-into-bitcoin-miners-09312529/>). 9 January 2014. Retrieved 8 January 2015.
291. "Infosecurity - Researcher discovers distributed bitcoin cracking trojan malware" (<http://www.infosecurity-magazine.com/view/20211/researcher->

- discovers-distributed-bitcoin-cracking-trojan-malware/). *Infosecurity-magazine.com*. 19 August 2011. Retrieved 24 January 2012.
292. Lucian Constantin (1 November 2011). "Mac OS X Trojan steals processing power to produce Bitcoins: Security researchers warn that DevilRobber malware could slow down infected Mac computers" (http://www.techworld.com.au/article/405849/mac_os_x_trojan_steals_processing_power_produce_bitcoins). *TechWorld*. IDG communications. Retrieved 24 January 2012.
293. "E-Sports Entertainment settles Bitcoin botnet allegations" (<http://www.bbc.co.uk/news/technology-25014477>). *BBC News*. 20 November 2013. Retrieved 24 November 2013.
294. Mohit Kumar (9 December 2013). "The Hacker News The Hacker News +1,440,833 ThAlleged Skynet Botnet creator arrested in Germany" (<http://thehackernews.com/2013/12/alleged-skynet-botnet-creator-arrested.html>). Retrieved 8 January 2015.
295. Liat Clark (20 January 2014). "Microsoft stopped Tor running automatically on botnet-infected systems" (<http://www.wired.co.uk/news/archive/2014-01/20/microsoft-removes-tor>). Retrieved 8 January 2015.
296. Hornyack, Tim (6 June 2014). "US researcher banned for mining Bitcoin using university supercomputers" (<http://www.pcworld.com/article/2360840/us-researcher-banned-for-mining-bitcoin-using-university-supercomputers.html>). *PC world.com* (IDG Consumer & SMB). Retrieved 13 June 2014.
297. Hajdarbegovic, Nermin (27 February 2014). "Nearly 150 strains of malware are after your bitcoins" (<http://www.coindesk.com/nearly-150-strains-malware-bitcoins/>). *CoinDesk*. Retrieved 7 March 2014.
298. Gregg Keizer (28 February 2014). "Bitcoin malware count soars as cryptocurrency value climbs" (<http://www.computerworld.com/article/2488144/malware-vulnerabilities/bitcoin-malware-count-soars-as-cryptocurrency-value-climbs.html>). *Computerworld*. Retrieved 8 January 2015.
299. Zach Miners (24 Feb 2014). "Bitcoins, other digital currencies stolen in massive 'Pony' botnet attack" (<http://www.pcworld.com/article/2101260/bitcoins-other-digital-currencies-stolen-in-massive-pony-botnet-attack.html>). Retrieved 8 January 2015.
300. Finkle, Jim (24 February 2014). "'Pony' botnet steals bitcoins, digital currencies: Trustwave" (<http://www.reuters.com/article/2014/02/24/us-bitcoin-security-idUSBREA1N1JO20140224>). *Reuters*. Retrieved 7 March 2014.
301. "Malware being spread via cracked apps" (<http://colombogazette.com/2014/02/26/malware-being-spread-via-cracked-apps/>). 26 February 2014. Retrieved 8 January 2015.
302. "How Ransomware turns your computer into a bitcoin miner" (<http://www.theguardian.com/technology/2014/feb/10/how-ransomware-turns-your-computer-bitcoin-miner-linkup>). *The Guardian*. 10 February 2014. Retrieved 7 March 2014.
303. Gibbs, Samuel (21 November 2013). "US police force pay bitcoin ransom in Cryptolocker malware scam" (<http://www.theguardian.com/technology/2013/nov/21/us-police-force-pay-bitcoin-ransom-in-cryptolocker-malware-scam>). *The Guardian*. Retrieved 7 March 2014.
304. Erik Bonadonna (29 March 2013). "Bitcoin and the Double-spending Problem" (<http://blogs.cornell.edu/info4220/2013/03/29/bitcoin-and-the-double-spending-problem/>). Cornell University. Retrieved 22 October 2014.
305. Karame, Ghassan O.; Androulaki, Elli; Capkun, Srdjan (2012). "Two Bitcoins at the Price of One? Double-Spending Attacks on Fast Payments in Bitcoin" (<http://eprint.iacr.org/2012/248.pdf>) (PDF). International Association for Cryptologic Research. Retrieved 22 October 2014.
306. Michael J. Casey; Paul Vigna (16 June 2014). "Short-Term Fixes To Avert '51% Attack'" (<http://blogs.wsj.com/moneybeat/2014/06/16/bitbeat-a-51-attack-what-is-it-and-could-it-happen/>). *Money Beat* (Wall Street Journal). Retrieved 30 June 2014.
307. Eyal, Ittay; Sirer, Emin Gun (15 November 2013). "Majority is not Enough: Bitcoin Mining is Vulnerable" (<http://arxiv.org/abs/1311.0243>). Retrieved 7 October 2014.
308. Hill, Kashmir (6 November 2013). "Bitcoin Is Not Broken" (<http://www.forbes.com/sites/kashmirhill/2013/11/06/bitcoin-is-not-broken/>). *Forbes*. Retrieved 19 October 2014.
309. Eyal, Ittay; Sirer, Emin Gun (8 November 2013). "Response to Fairweather Mining" (<http://hackingdistributed.com/2013/11/08/fairweather-mining/>). Retrieved 28 May 2015.
310. Eyal, Ittay; Sirer, Emin Gun (14 November 2013). "Response to Fairweather Mining" (<http://hackingdistributed.com/2013/11/14/response-to-feedback-on-selfish-mining/>). Retrieved 28 May 2015.
311. Reid, Fergal; Harrigan, Martin (2013). "An Analysis of Anonymity in the Bitcoin System". *Security and Privacy in Social Networks*: 197–223.
312. Biryukov, Alex; Khovratovich, Dmitry; Pustogarov, Ivan (2014). "Deanonymisation of clients in Bitcoin P2P network" (<http://orbilu.uni.lu/handle/10993/18679>). *ACM Conference on Computer and Communications Security*.
313. Higginbotham, Stacey (9 September 2014). "Check out IBM's proposal for an internet of things architecture using Bitcoin's block chain tech" (<https://gigaom.com/2014/09/09/check-out-ibms-proposal-for-an-internet-of-things-architecture-using-bitcoins-block-chain-tech/>). *gigaom.com*. Gigaom. Retrieved 29 April 2015.
314. Barker, Colin (21 January 2015). "Is blockchain the key to the Internet of Things? IBM and Samsung think it might just be" (<http://www.zdnet.com/article/is-blockchain-the-key-to-the-internet-of-things-ibm-and-samsung-think-it-might-just-be/>). ZDNet. Retrieved 29 April 2015.
315. Gertrude Chavez-Dreyfuss (Mar 12, 2015). "IBM looking at adopting bitcoin technology for major currencies" (<http://www.reuters.com/article/2015/03/12/us-bitcoin-ibm-idUSKBN0M82KB20150312>). *Reuters*. Retrieved 13 March 2015.
316. Hern, Alex (13 May 2015). "Nasdaq bets on bitcoin's blockchain as the future of finance" (<http://www.theguardian.com/technology/2015/may/13/nasdaq-bitcoin-blockchain>). *theguardian.com*. The Guardian. Retrieved 22 May 2015.
317. Shin, Laura (24 June 2015). "Nasdaq Selects Bitcoin Startup Chain To Run Pilot In Private Market Arm" (<http://www.forbes.com/sites/laurashin/2015/06/24/nasdaq-selects-bitcoin-startup-chain-to-run-pilot-in-private-market-arm/>). *Forbes*. Retrieved 25 June 2015.
318. Chavez-Dreyfuss, Gertrude (15 May 2015). "Honduras to build land title registry using bitcoin technology" (<https://uk.news.yahoo.com/honduras-build-land-title-registry-using-bitcoin-technology-162701917.html>). *Yahoo News*. Retrieved 22 June 2015.
319. "How porn links and Ben Bernanke snuck into Bitcoin's code" (<http://money.cnn.com/2013/05/02/technology/security/bitcoin-porn/>). *CNN Money*. CNN.
320. Paul Vigna (18 February 2014). "BitBeat: Mt. Gox's Pyrrhic Victory" (<http://blogs.wsj.com/moneybeat/2014/02/18/bitbeat-mt-goxs-pyrrhic-victory/>). *Money Beat*. The Wall Street Journal. Retrieved 30 September 2014. "'Ode to Satoshi' is a bluegrass-style song with an old-timey feel that mixes references to Satoshi Nakamoto and blockchains (and, ahem, 'the fall of old Mt. Gox') with mandolin-picking and harmonicas."
321. Patrick Seitz (21 March 2014). "Bitcoin confusion is comedy gold" (<http://news.investors.com/technology-click/032114-694251-comedians-cannot-explain-bitcoin-but-think-it-is-funny.htm>). *Investors Business Daily, Tech News & Commentary* (William O'Neil + Co. Incorporated). Retrieved 5 September 2014.
322. "The Good Wife: Season 3, Episode 13 Bitcoin for Dummies (15 Jan. 2012)" (http://www.imdb.com/title/tt2148561/?ref_=ttep_ep13). *imdb.com*. IMDb. Retrieved 8 May 2015.
323. Kenigsberg, Ben (2 October 2014). "Financial Wild West" (http://www.nytimes.com/2014/10/03/movies/the-rise-and-rise-of-bitcoin-from-nicholas-mross.html?_r=0). *nytimes.com*. New York Times. Retrieved 8 May 2015.
324. Hern, Alex (30 April 2014). "MIT students to get \$100 worth of bitcoin from Wall Street donor" (<http://www.theguardian.com/technology/2014/apr/29/mit-student-bitcoin-wall-street-donor>). *The Guardian*. Retrieved 1 May 2014.
325. Dan (29 April 2014). "Announcing the MIT Bitcoin Project" (<http://bitcoin.mit.edu/announcing-the-mit-bitcoin-project/>). MIT Bitcoin Club. Retrieved 4 July 2015.
326. Jason Kurtz (February 20, 2015). "Buying bitcoin: Morgan Spurlock looks to live off online currency" (<http://www.cnn.com/2015/02/18/us/bitcoin-morgan-spurlock-inside-man/>). CNN. Retrieved 25 February 2015.
327. ...[E]very exchange between two beacons must be cryptographically signed by a third party bank in another star system: it take years to settle a transaction. It's theft-proof too – for each bitcoin is cryptographically signed by the mind of its owner. Charles Stross. *Neptune's Brood* (Kindle edition). Ace, 2013, p.109 (reference (<http://www.overcomingbias.com/2013/10/econ-realism-in-neptunes-brood.html>); citation on the Google Books (https://books.google.de/books?id=nEeFRxTx_F4C&printsec=frontcover&hl=de#v=onepage&q=bitcoin&f=false))

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(https://www.dmoz.org/Science/Social_Sciences/Economics/Financial_Economics/Currency_and_Money/Alternative_Monetary_Systems/Bitcoin) at DMOZ

- Bitcoin video series (<https://www.khanacademy.org/economics-finance-domain/core-finance/money-and-banking/bitcoin/v/bitcoin-what-is-it>) at Khan Academy
- Bitcoin: a cryptographic currency (http://cert.inteco.es/extfrontinteco/img/File/intecocert/EstudiosInformes/int_bitcoin_en.pdf) Bitcoin, Instituto Nacional de Tecnologías de la Comunicación (INTECO), Spain, or National Institute of Communication Technologies (undated, 47pp, in English).
- Quandl - Bitcoin currency data (<https://www.quandl.com/c/markets/bitcoin-data>) - historical statistics in time series downloadable format.

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