



BITCOIN FORENSICS: FACT OR FICTION?

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MARKET PRICE



BITCOIND DAEMON

- Protocol
- Command line
- Remote procedure calls
- Graphical user interfaces

USAGE

- Wallet = address + address + address + ...
- 1HB5XMLmzFVj8ALj6mfBsbifRoD4miY36v
- Coins 0.00000001 – 1 BTC

TRANSACTIONS

- Public key ~ address
- Private key ~ signature
- Transactions -> blocks -> block chain

NOTHING IS ENCRYPTED

- Encryption vs Cryptography
- Anonymity vs Privacy

INVESTIGATION SCOPE

- Client software
- Network communications
- Transactions database
- Surrounding ecosystem

WALLETS

- Desktop: Bitcoin Core, MultiBit, Hive, Armory, Electrum
- Mobile: Bitcoin Wallet, Mycelium Wallet
- Web: Blockchain Info, BitGo, GreenAddress, Coinbase, Coinkite

WALLET.DAT

wallet.dat																	
	Edit As: Hex			Run Script			Run Template										
	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F	0123456789ABCDEF
0000h:	00	00	00	00	01	00	00	00	00	00	00	00	62	31	05	00	.....b1..
0010h:	09	00	00	00	00	20	00	00	00	09	00	00	00	00	00	00	.....
0020h:	0B	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	.....
0030h:	20	00	00	00	0F	A9	00	00	00	00	03	00	04	9B	97	0D	...@.....>.
0040h:	00	00	00	00	00	00	00	00	00	00	00	00	02	00	00	00	.....
0050h:	00	00	00	00	20	00	00	00	01	00	00	00	00	00	00	00	.....

wallet.encrypted.dat																	
	Edit As: Hex			Run Script			Run Template										
	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F	0123456789ABCDEF
0000h:	00	00	00	00	01	00	00	00	00	00	00	00	62	31	05	00	.....b1..
0010h:	09	00	00	00	00	20	00	00	00	09	00	00	00	00	00	00	.....
0020h:	07	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	.....
0030h:	20	00	00	00	57	A9	00	00	00	00	72	05	93	8C	59	2B	...W@....r."EY+
0040h:	00	00	00	00	00	00	00	00	00	00	00	00	02	00	00	00	.....
0050h:	00	00	00	00	20	00	00	00	01	00	00	00	00	00	00	00	.....

wallet.dat																	
	Edit As: Hex			Run Script			Run Template										
	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F	0123456789ABCDEF
2000h:	00	00	00	00	01	00	00	00	01	00	00	00	00	00	00	00	.....
2010h:	00	00	00	00	02	00	F0	1F	01	05	F8	1F	F0	1F	00	00	.....8...ø.8...
2020h:	01	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	.....
2030h:	20	00	00	00	0F	A9	00	00	00	00	03	00	04	9B	97	0D	...@.....>.
2040h:	00	00	00	00	00	00	00	00	00	00	00	00	02	00	00	00	.....
2050h:	00	00	00	00	20	00	00	00	01	00	00	00	00	00	00	00	.....

wallet.encrypted.dat																	
	Edit As: Hex			Run Script			Run Template										
	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F	0123456789ABCDEF
2000h:	00	00	00	00	01	00	00	00	01	00	00	00	00	00	00	00	.....
2010h:	00	00	00	00	02	00	F0	1F	01	05	F8	1F	F0	1F	00	00	.....8...ø.8...
2020h:	01	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	.....
2030h:	20	00	00	00	57	A9	00	00	00	00	72	05	93	8C	59	2B	...W@....r."EY+
2040h:	00	00	00	00	00	00	00	00	00	00	00	00	02	00	00	00	.....
2050h:	00	00	00	00	20	00	00	00	01	00	00	00	00	00	00	00	.....

wallet.dat																	
	Edit As: Hex			Run Script			Run Template										
	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F	0123456789ABCDEF
3FF0h:	04	00	01	00	00	00	02	00	04	00	01	6D	61	69	6E	00	.....main.
4000h:	00	00	00	00	01	00	00	00	02	00	00	00	62	31	05	00	.....b1..
4010h:	09	00	00	00	00	20	00	00	00	09	00	00	00	00	00	00	.....
4020h:	02	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	.....
4030h:	20	00	00	00	0F	A9	00	00	00	00	03	00	04	9B	97	0D	...@.....>.
4040h:	00	00	00	00	00	00	00	00	00	00	00	00	02	00	00	00	.....

wallet.encrypted.dat																	
	Edit As: Hex			Run Script			Run Template										
	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F	0123456789ABCDEF
3FF0h:	04	00	01	00	00	00	02	00	04	00	01	6D	61	69	6E	00	.....main.
4000h:	00	00	00	00	01	00	00	00	02	00	00	00	62	31	05	00	.....b1..
4010h:	09	00	00	00	00	20	00	00	00	09	00	00	00	00	00	00	.....
4020h:	02	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	.....
4030h:	20	00	00	00	57	A9	00	00	00	00	72	05	93	8C	59	2B	...W@....r."EY+
4040h:	00	00	00	00	00	00	00	00	00	00	00	00	02	00	00	00	.....

ADDRESSES

```

1:6E00h: 69 76 65 00 2B 00 01 07 70 75 72 70 6F 73 65 22  ive.+...purpose"
1:6E10h: 31 4D 68 4A 79 52 7A 4C 4E 62 67 43 36 6B 55 53  1MhJyRzLNbgC6kUS
1:6E20h: 61 4D 43 7A 45 71 42 7A 52 75 32 70 43 62 5A 5A  aMCzEqBzRu2pCbZZ
1:6E30h: 68 76 00 00 2E 00 01 F4 5F 01 00 D7 CB 87 53 00  hv.....δ...*E+S.
1:6E40h: 00 00 00 21 03 E4 77 92 23 12 40 77 CF 7E 2D D6  ...!.äw'#.wI~-Ö
1:6E50h: 45 E1 B9 A9 CE 31 14 67 E7 83 3C 62 54 91 A9 75  Eá'@Î1.gçf<bT'@u
1:6E60h: EE 9B 49 13 8F 6A 6D 6B 0D 00 01 04 70 6F 6F 6C  i>I..jmk....pool
1:6E70h: 6A 00 00 00 00 00 00 00 0C 00 01 01 00 00 00 D7  j.....*
1:6E80h: CB 87 53 00 00 00 00 37 2A 00 01 07 6B 65 79 6D  E+S....7*...keym
1:6E90h: 65 74 61 21 03 E4 77 92 23 12 40 77 CF 7E 2D D6  eta!.äw'#.wI~-Ö
1:6EA0h: 45 E1 B9 A9 CE 31 14 67 E7 83 3C 62 54 91 A9 75  Eá'@Î1.gçf<bT'@u
1:6EB0h: EE 9B 49 13 8F 00 01 07 08 00 01 07 72 65 63 65  i>I.....rece
1:6EC0h: 69 76 65 07 2B 00 01 07 70 75 72 70 6F 73 65 22  ive.+...purpose"
1:6ED0h: 31 4E 39 67 71 76 58 6F 46 73 36 63 68 61 77 55  1N9gqvXoFs6chawU
1:6EE0h: 48 68 39 43 34 36 47 77 74 54 6D 52 62 4E 52 52  Hh9C46GwtTmRbNRR
1:6EF0h: 37 57 65 00 08 00 01 07 72 65 63 65 69 76 65 22  7We.....receive"
1:6F00h: 2B 00 01 07 70 75 72 70 6F 73 65 22 31 35 7A 33  +...purpose"15z3
1:6F10h: 5A 54 64 75 53 79 79 67 34 68 36 68 62 71 65 79  ZTduSyyg4h6hbqey
1:6F20h: 67 5A 52 76 53 5A 5A 6E 4E 36 62 55 34 6D 53 00  gZRvSZZnN6bU4mS.
1:6F30h: 08 00 01 07 72 65 63 65 69 76 65 00 2B 00 01 07  ....receive.+...
1:6F40h: 70 75 72 70 6F 73 65 22 31 34 37 55 45 64 65 4E  purpose"147UEdeN
1:6F50h: 5A 58 34 79 6F 66 62 51 4C 78 4B 79 6A 6D 6B 69  ZX4yofbQLxKyjmkI
1:6F60h: 74 45 4A 31 33 63 53 42 53 65 00 00 2E 00 01 F4  tEJ13cSBSe.....δ

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1:6F80h: 40 4B E5 8C 13 B7 C3 BE DA B2 DB 13 72 AF C5 A3  @K&E..Ä%Ü*Ü.r~ÄE
1:6F90h: 09 BA 81 34 09 12 CA 72 86 AC 5F 86 DB 8B 75 1E  .°.4..Ërt~_tÜ<u.
1:6FA0h: 0D 00 01 04 70 6F 6F 6C 69 00 00 00 00 00 00 00  ....pooli.....
1:6FB0h: 0C 00 01 01 00 00 00 5F 7C 87 53 00 00 00 00 00  ...._|#S.....
1:6FC0h: 2A 00 01 07 6B 65 79 6D 65 74 61 21 02 E3 45 56  *...keymeta!.äEV
1:6FD0h: 40 4B E5 8C 13 B7 C3 BE DA B2 DB 13 72 AF C5 A3  @K&E..Ä%Ü*Ü.r~ÄE
1:6FE0h: 09 BA 81 34 09 12 CA 72 86 AC 5F 86 DB 00 00 00  .°.4..Ërt~_tÜ...
1:6FF0h: 08 00 01 07 72 65 63 65 69 76 65 00 2B 00 01 07  ....receive.+...
1:7000h: 70 75 72 70 6F 73 65 22 31 45 75 6E 68 68 56 79  purpose"1EunhhVy
1:7010h: 43 65 57 48 51 71 62 61 4C 43 67 38 73 76 61 48  CeWHQqbaLCg8svaH
1:7020h: 65 70 76 67 41 42 5A 4D 34 46 FF FF 2E 00 01 F4  epvgABZM4Fÿÿ...δ
1:7030h: 5F 01 00 5A 7C 87 53 00 00 00 00 21 03 05 D2 F4  _..Z|#S.....!...Öδ
1:7040h: 20 76 65 99 3E 10 C7 E6 0D EA BD 49 DA 2A EC 5D  ve">.Çæ.è%IÜ*ij
1:7050h: 6E E2 14 A5 BE 8D EF 6A 9D 8A C6 55 C4 00 00 00  ná.¥%.ij.ŠEUÄ...
1:7060h: 0D 00 01 04 70 6F 6F 6C 68 00 00 00 00 00 00 00  ....poolh.....
1:7070h: 0C 00 01 01 00 00 00 5A 7C 87 53 00 00 00 00 00  ....Z|#S.....
1:7080h: 2A 00 01 07 6B 65 79 6D 65 74 61 21 03 05 D2 F4  *...keymeta!..Öδ
1:7090h: 20 76 65 99 3E 10 C7 E6 0D EA BD 49 DA 2A EC 5D  ve">.Çæ.è%IÜ*ij
1:70A0h: 6E E2 14 A5 BE 8D EF 6A 9D 8A C6 55 C4 FF FF FF  ná.¥%.ij.ŠEUÄÿÿÿÿ
1:70B0h: 08 00 01 07 72 65 63 65 69 76 65 00 2B 00 01 07  ....receive.+...
1:70C0h: 70 75 72 70 6F 73 65 22 31 39 4C 47 72 50 43 79  purpose"19LGrPCy
1:70D0h: 37 57 51 62 53 41 67 6B 67 31 58 46 78 4E 4D 31  7WQbSAGkg1XfXNM1
1:70E0h: 7A 63 42 69 73 53 46 67 78 72 FF FF 08 00 01 04  zcBisSFgxryÿÿ....

```

EVIDENCE

- Addresses
- Transaction details
- Wallet and backup files

NETWORK TRAFFIC

No.	Time	Source	Destination	Protocol	Length	Info
4854	45.9585540	172.29.185.229	88.186.79.57	Bitcoin	176	inv, getdata
4860	45.9669270	172.29.185.229	75.80.98.68	Bitcoin	115	inv
4887	46.0638520	88.186.79.57	172.29.185.229	Bitcoin	303	tx
4898	46.1066320	172.29.185.229	107.170.96.221	Bitcoin	151	inv
+ Frame 4887: 303 bytes on wire (2424 bits), 303 bytes captured (2424 bits) on interface 0						
+ Ethernet II, Src: Dell_d1:38:b8 (d4:ae:52:d1:38:b8), Dst: IntelCor_97:52:07 (c4:85:08:97:52:07)						
+ Internet Protocol Version 4, Src: 88.186.79.57 (88.186.79.57), Dst: 172.29.185.229 (172.29.185.229)						
+ Transmission Control Protocol, Src Port: 8333 (8333), Dst Port: 22440 (22440), Seq: 1202, Ack: 2103, Len: 249						
- Bitcoin protocol						
Packet magic: 0xf9beb4d9						
Command name: tx						
Payload Length: 225						
Payload checksum: 0x1f887915						
Tx message						
Transaction version: 1						
Input Count: 1						
Transaction input						
Previous output						
Script Length: 106						
Signature script: 47304402205f2e2cd56ffa1fe12a6cf604a2e2083c7067ee...						
Sequence: 4294967295						
Output Count: 2						
Transaction output						
Value: 654321						
Script Length: 25						
Script: 76a9145b6624433659c803260ecbcf099bdebdbf9aa62f88...						
Transaction output						
Value: 335679						
Script Length: 25						
Script: 76a9140c679bc044d7a023aa4bf688248e9a49d385bf8488...						
0000	c4 85 08 97 52 07 d4 ae 52 d1 38 b8 08 00 45 00	....R... R.8...E.				
0010	01 21 3e c2 40 00 30 06 fd 1e 58 ba 4f 39 ac 1d	.!>.@.0. ..X.O9..				

IP DISCLOSURE

```
5-16 11:04:26 GetMyExternalIP() received [74.12.189.38] 74.12.189.38:0
5-16 11:04:26 GetMyExternalIP() returned 74.12.189.38
5-16 11:04:26 AddLocal(74.12.189.38:8333,4)
5-16 11:04:26 ext-ip thread exit
5-16 11:04:27 receive version message: /Satoshi:0.9.1/: version 70002, blocks=301021, us=74.12.189.38:59804, them=96.127.190.250:8333, peer=96.127.190.250
5-16 11:04:27 Added time data, samples 2, offset +8 (+0 minutes)
5-16 11:04:28 receive version message: /Satoshi:0.9.99/: version 70002, blocks=301021, us=74.12.189.38:63437, them=192.241.188.47:8333, peer=192.241.188.47
5-16 11:04:28 Added time data, samples 3, offset +1 (+0 minutes)
```

Transactions Relayed By 70.69.238.84 Transactions that were relayed first by the ip 70.69.238.84

9c3278928cf4a2defdbd4b5b512a875519d590d8a597ccda7877435b0991b0a7

2014-05-29 20:57:56

1B3BfWXz1naSg8UBgbeBVGBkYLDqqnhaAm
128cRgDc66uR8qMJobHvVxgdCJXdiSUW1j
1PX1dyhHGvoJa1s1DtEGyvBxpFKFHZbt2
14chTgYyv2VRxkdVG9e5HSFncBw2gtV2pV



1Lq9E8JsfyrjAyNPFvnm6MJugdVib44tvB
1JThw7QnwM5mFNaYrtv7j7yZvVXknDsoZP

0.01000357 BTC
0.00502 BTC

0.01502357 BTC

Total Connected: 436

IP	Port	Client Version	Sub Version
195.154.169.155	8333	70002	/Satoshi:0.9.1/
70.69.238.84	8333	70001	/Satoshi:0.8.6/

EVIDENCE

- IP addresses
- Transaction details

BLOCK CHAIN

Block height	303251
Block time	2014-05-30 04:25:18
Grades sum	9,884.98637622 BTC
Block txs	979
Block difficulty	10,455,720,138.485
Block fee	0.16870347 BTC
Block hash	000000000000000018ebe728e653d0ced8704b1ec88f8a93978d733ae6ada310
Block version	2
Block confirmations	1
Block merkle root	3480fd6a10b97d94194a1a6047c245ae9612dc5f97b80aac6975700f4856875f
Block prev block hash	00000000000000003d064dce6041a89b9b333d9300a633b42f85027aa7892727
Block size	592.96 kB
Block coin days destroyed	61,133.1 ?

Block height	Block created	Transactions	Block fee	Size (kb)	Days destroyed
303251	7 minutes ago	979	0.16870347	592.96 kB	61,133
303250	37 minutes ago	341	0.03630870	203.17 kB	468
303249	41 minutes ago	175	0.02801914	140.17 kB	2,359
303248	45 minutes ago	625	0.10788094	367.28 kB	2,994
303247	1 hour 4 minutes ago	514	0.08476355	340.59 kB	1,434

PUBLIC TRANSACTIONS

46f9b3f469812745c00a3b525d13125a6af85769efbd21729e7205f4e36733a4

13Svmzu71NKzddyEA5gk1KeGwwc5zEn9nQ (0.01048322 BTC - Output)
1LzvdM9JCLXZhXCeydMeAeH6JurJPhKhfo (3.12922644 BTC - Output)
1Lx7ByezM7XgEytTKNG6oPNvg1z4mSXS7e (0.0324733 BTC - Output)
1HzZGzG2qyCHyNxMyBPVUbVB2hKv24zUC (0.01039426 BTC - Output)



1KZLvzS9153EAH5kFLbtDRd1XvtqmS2ZMM - (Spent) 3.17234218 BTC
1FFLFPhyuTiDW9NhQkjgsK9jJU5U8voSED - (Spent) 0.01013504 BTC

12 Confirmations

3.18247722 BTC

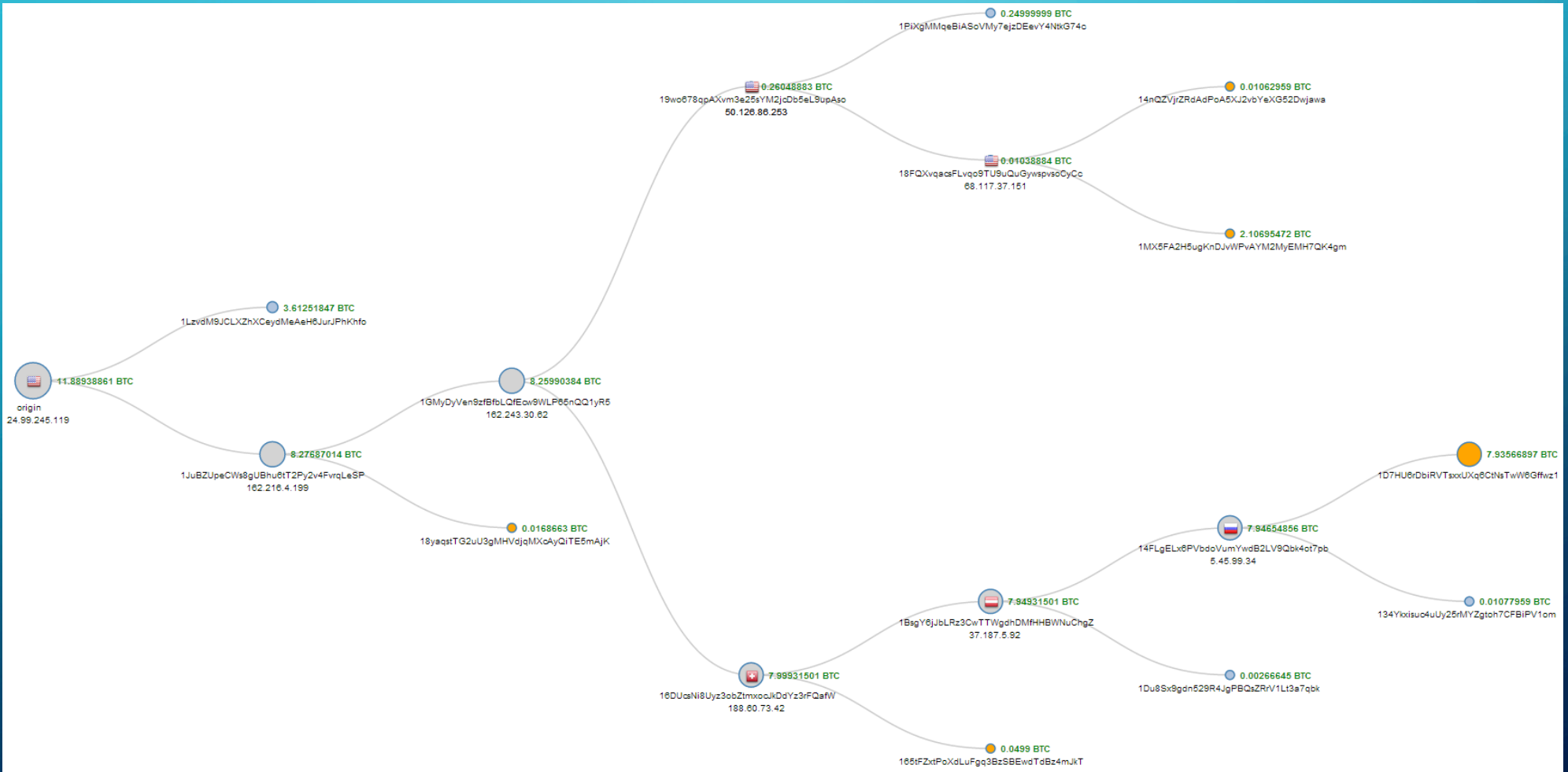
Summary

Size	669 (bytes)
Received Time	2014-05-30 05:18:46
Included In Blocks	303278 (2014-05-30 05:29:24 +11 minutes)
Confirmations	12 Confirmations
Relayed by IP	149.210.133.244 (whois)

Inputs and Outputs

Total Input	3.18257722 BTC
Total Output	3.18247722 BTC
Fees	0.0001 BTC
Estimated BTC Transacted	3.17234218 BTC
Scripts	Hide scripts & coinbase

MONEY FLOW



COMMON PATTERNS

17gH1u6VJwhVD9cWR59jfeinLMzag2GZ43



1MK3Qmu8rfUwd4xsZxfsGEmdCDKrkWJecM
1PVd9iQJrw8thpWzVBw8QfuU786hr72uwG

0.59697034 BTC
13.28292966 BTC

1KqcQhxxhYMScd9fzdnjgzwFzMWJoPAoZ6
18fpZf2TBMjMGjsxTSQ4qT61oNmWoNbFwp
1LxSfELv97wDFQ9NTqte7b3RrxU3iJTV4q
18D9AsahQzZM86Bc4T55TkASfKnY22x2tT
16oHajrphZJKRAo2FvzYNSD95pzoqpmcLF
1DSKSWGWHUhbVuCGJZiDRraAjx9DkN9Ckby
1ApUjaQL69wV4xexpzonb8818fcraqYZhQ
1y8KNwoCK6QeKcPKwBgF3uPsq7aEpVTpD
1P2u9NV03prLa5jJhHpyrCV3Ej9No8mnoo
1PeAj9jCA8Di2rBWLiv9fpAxfgYhcgJeQ



17gH1u6VJwhVD9cWR59jfeinLMzag2GZ43

13.88 BTC

EVIDENCE

- Money flow
- Transaction details
- Advanced correlations

WEB WALLETS

- IP address
- HTTP headers
- Geolocation
- ...

EXCHANGERS

- IP address
- HTTP headers
- Geolocation
- ...
- Identification
- Payment details

INTERNET SHOPS

- IP address
- HTTP headers
- Geolocation
- ...
- Identification
- Shipping address

PROFILING

13hVkumuq942sAN9moZxkch59pL99KHUS



18LDvu2nqr8a5AK9AHkkqDK6Z65dzbTgtn	0.001 BTC
1AkZUyVHtVsU6Z... (The Liberty Radio Network ↗)	0.001 BTC
1DVipMAKrZgtmV... (Free Talk Live ↗)	0.001 BTC
1DXqjYYcjgeTrtDSG9EH1Kc8UKwiJgMCXy	0.001 BTC
1Fd8RuZqJNG4v56... (FreeDomainRadio.com ↗)	0.001 BTC
1BTCorgHwCg6u2... (Bitcoin Foundation ↗)	0.0005 BTC
1HB5XMLmzFVj8A... (WikiLeaks ↗)	0.001 BTC
1Hy8xL2ey3GwFLTEd3NTS76A3bWMnQ2dRP	0.001 BTC
1JZuqEaKQCUqUKZULu3dFiaBhi9Xkn8ZXL	0.001 BTC
1M87hiTAa49enJK... (Antiwar.com ↗)	0.001 BTC
1N1pF6fLKAGg4nH7XuqYQbKYXNxCnHBWLB	0.0005 BTC
1PtnAAWq6J9CdcahRtdwJtrdVu4V8ovKSS	0.001 BTC
1snowqQP5VmZg... (Official Snowden Defense Fund ↗)	0.001 BTC
1UN8betDtQnp7gA6Bm1oiw1DZyNsjKjhW	0.0005 BTC
32wRDBezxnazSBxMrMqLWqD1ajwEqnDnMc	0.001 BTC
13hVkumuq942sAN9moZxkch59pL99KHUS	0.02778312 BTC

EVIDENCE

- Connection details
- Offline information

PREDICTIONS

- Decentralized vs Distributed
- Credit Cards vs Bitcoins
- Bitcoins vs Forks

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