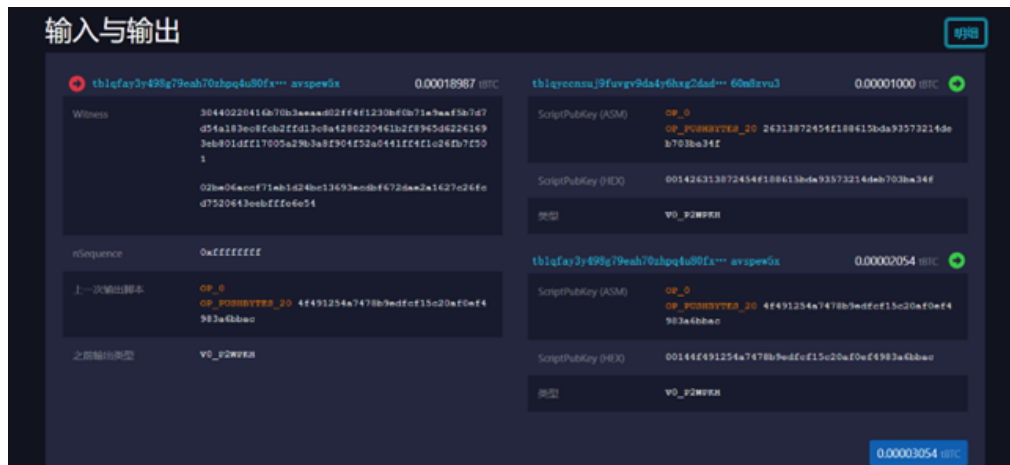


We conducted our experiments using the Bitcoin Testnet3 network (<https://mempool.space/testnet/>), with all tests performed on the mempool.space Bitcoin test network.

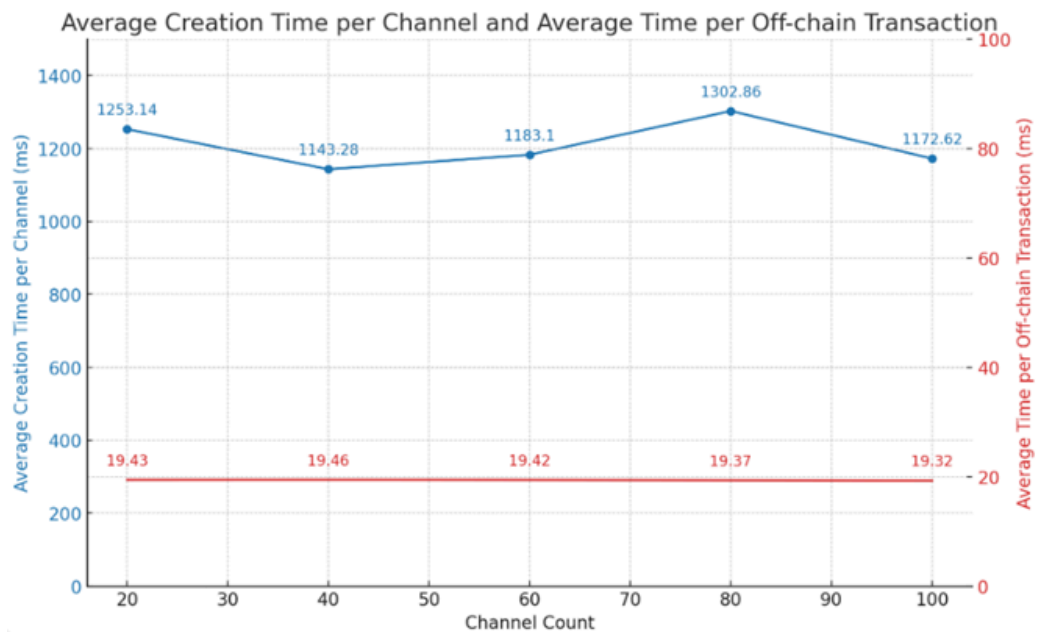
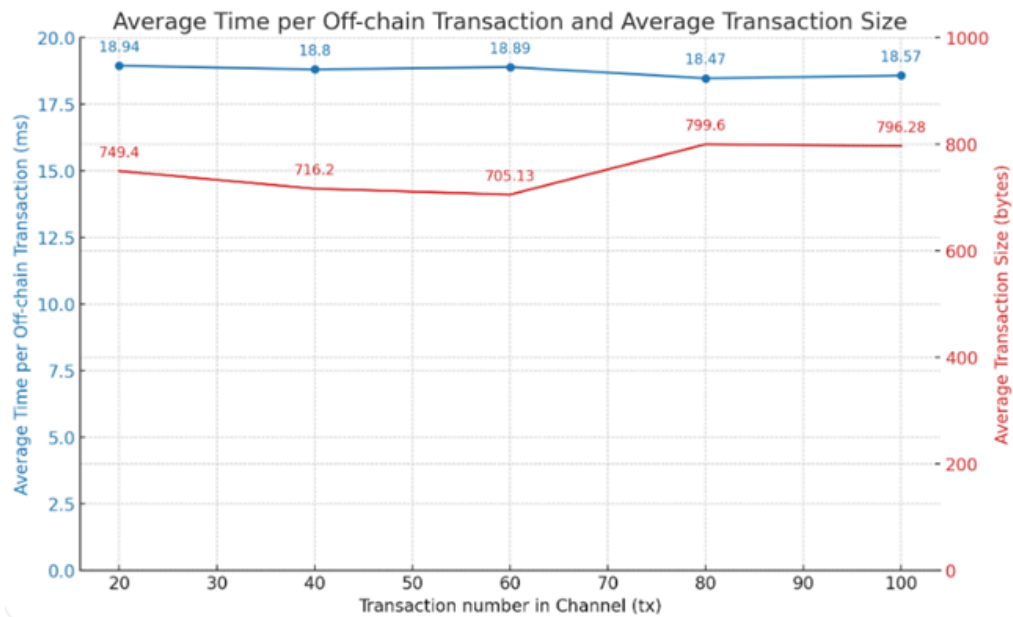


The experiment is divided into three main parts:

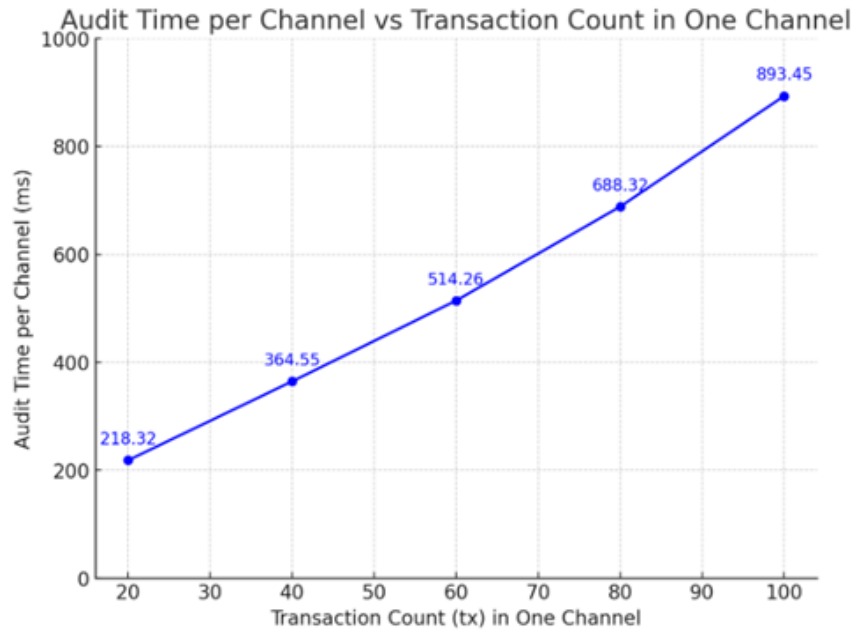
Part 1: Creating off-chain channels and simulating off-chain transactions. First, we initiated 20, 40, 60, 80, and 100 transactions within a single channel and measured the time taken to create each off-chain transaction. Then, we created 20, 40, 60, 80, and 100 off-chain channels, each with the same 20 transactions. We observed that the transaction creation time includes both the assertion and verification phases. Additionally, we recorded the size (in bytes) of each transaction after attaching the assertion as an auxiliary field. From the results, we found that the time to create off-chain transactions remained almost constant, regardless of the total number of transactions in the channel. Similarly, the time for creating off-chain channels nearly unchanged as the number of channels increased.

The figure below displays an auxiliary field for the assertion following each transaction.





Part 2: Closing off-chain channels and simulating audit times for varying numbers of transactions. We evaluated the audit time for channels with 20, 40, 60, 80, and 100 off-chain transactions. The results showed that audit time increased linearly with the number of transactions.



Part 3: Details of transactions in the experiment

Below are excerpts of the transaction IDs from our experiment involving the creation of channels on the Bitcoin Testnet3 network (<https://mempool.space/testnet/>).

1. tx id:d16ed57d7af78d7e469ab30768d6d4848bd63ee702a7a24957f435d987d5056d
2. tx id:4288496ad69a1f7133e776113c8abd9243c87a16f60284c51c5395b67628701f
3. tx id:705632e7bf8b94f8229f7189f19401b9dff0cbfe21f0904e11705d93a66a3a78
4. tx id:d3cdfdadd44726fac64f4ef7e45291e0844abd694f16974155cc755af3af7907
5. tx id:4cfd44d2463e1df0188b7bbf2049b74a864f367f4c6890acff69c235ee51ee05
6. tx id:fcbd4675291b878fb46b560c25677fdbb8160809699bf234ab35ef716a7224af
7. tx id:94c2c53f3d5a2892b8474a7729e382a4af35d5fba515d715b502bd0b94ebd397
8.

Transaction ID	Input address	Output address	transaction fee	Witness	Last output scripts	ScriptPubKey (ASM)	ScriptPubKey (HEX)	OP_RETURN	Transaction broadcast time (s)
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d16ed57d7af 78d7e469ab3 0768d6d4848 bd63ee702a7 a24957f435d 987d5056d	tb1qfay 3y498g 79eah7 0zhpq4 u80fxp6 dwavsp ew5x	tb1qycc nsuj9fu vgv9da 4y6hxg 2dadcrh g60m8z vu3	2990	304402202d9c383ba2aa 755ea19fac381dc3d96ef 78b3917ee8b75ee53330 d1365eaf1bc0220294f76 b096c1020bc851487bd6 98368647d689ceb0eb14 e16ce5db63f019e27901 02be06accf71eb1d24bc1 3693ecdbf672dae2a162 7c26fcd7520643eebffe6 e54	OP_PUSHB YTES_20 4f491254a74 78b9edfcf15 c20af0ef498 3a6bbac	OP_PUSH BYTES_20 263138724 54f188615 bda935732 14deb703b a34f	00142631 3872454f1 88615bda 93573214 deb703ba 34f	0b9900ee 217b924e 39219d59 4f4d2cd09 e56c56cb aa8aacac 12df01bb5 7416fe	1.24
4288496ad69 a1f7133e776 113c8abd924 3c87a16f602 84c51c5395b 67628701f	tb1qfay 3y498g 79eah7 0zhpq4 u80fxp6 dwavsp ew5x	tb1qycc nsuj9fu vgv9da 4y6hxg 2dadcrh g60m8z vu3	1,054	304402200c3175bef955 0a52f9653037349f11dfd b78422b3486f3cdb2da6 ed223b9cfe902200d671 6669ec163cbd52cb66cd 19955e83733b4e84c640 f48e090a5dacb8565410 1 02be06accf71eb1d24bc1 3693ecdbf672dae2a162 7c26fcd7520643eebffe6 e54	OP_PUSHB YTES_20 4f491254a74 78b9edfcf15 c20af0ef498 3a6bbac	OP_PUSH BYTES_20 263138724 54f188615 bda935732 14deb703b a34f	00142631 3872454f1 88615bda 93573214 deb703ba 34f	0b9900ee 217b924e 39219d59 4f4d2cd09 e56c56cb aa8aacac 12df01bb5 7416fe	1.13
705632e7bf8 b94f8229f718 9f19401b9dff 0cbfe21f0904 e11705d93a6 6a3a78	tb1qfay 3y498g 79eah7 0zhpq4 u80fxp6 dwavsp ew5x	tb1qycc nsuj9fu vgv9da 4y6hxg 2dadcrh g60m8z vu3	1990	304402202b3d06efa3ab 50d940d859e35ec59dbd d56a7394ef862b5d9b7b 38982d3abe54022026c8 9b62296875bdcd362756 6cfa5cab393c0ff92b9d14 eba48e6c81afc5c41201 02be06accf71eb1d24bc1 3693ecdbf672dae2a162 7c26fcd7520643eebffe6 e54	OP_PUSHB YTES_20 4f491254a74 78b9edfcf15 c20af0ef498 3a6bbac	OP_PUSH BYTES_20 263138724 54f188615 bda935732 14deb703b a34f	00142631 3872454f1 88615bda 93573214 deb703ba 34f	0b9900ee 217b924e 39219d59 4f4d2cd09 e56c56cb aa8aacac 12df01bb5 7416fe	1.17
d3cdfdadd44 726fac64f4ef 7e45291e084 4abd694f169 74155cc755af 3af7907	tb1qycc nsuj9fu vgv9da 4y6hxg 2dadcrh g60m8z vu3	tb1qfay 3y498g 79eah7 0zhpq4 u80fxp6 dwavsp ew5x	200	3044022004b4256c513a 8fd4d4cb9732a6151bc1 478f9545888cabef7c6d6 512f233c663022067cfce dfb43e680ce29c869b4b be4003c0e44f215fc8530 3e8f14ae2e595153401 02abcb31bb2546eb5b6e 67ae49ed0c21cd575edd b909e804b6cb91b62686 8cf10e	OP_PUSHB YTES_20 4f491254a74 78b9edfcf15 c20af0ef498 3a6bbac	OP_PUSH BYTES_20 4f491254a 7478b9edf cf15c20af0 ef4983a6b bac	00144f491 254a7478 b9edfcf15c 20af0ef49 83a6bbac	0b9900ee 217b924e 39219d59 4f4d2cd09 e56c56cb aa8aacac 12df01bb5 7416fe	1.29

4cfd44d2463 e1df0188b7b bf2049b74a8 64f367f4c689 0acff69c235e e51ee05	tb1qycc nsuj9fu vgv9da 4y6hxx 2dadcrh g60m8z vu3	tb1qfay 3y498g 79eah7 0zhpq4 u80fxp6 dwavsp ew5x	200	30440220367a346941db 0fa8bd13d959b294bfc4a a1dd7a6c67ba8bd16f23 c04ea128049022048830 73d4000a7a05a5a55c82 a48f8ea2ae9b33df781a3 228147095146e197fb01 02abcb31bb2546eb5b6e 67ae49ed0c21cd575edd b909e804b6cb91b62686 8cf10e	OP_PUSHB YTES_20 2631387245 4f188615bda 93573214de b703ba34f	OP_PUSH BYTES_20 4f491254a 7478b9edf cf15c20af0 ef4983a6b bac	00144f491 254a7478 b9edfcf15c 20af0ef49 83a6bbac	0b9900ee 217b924e 39219d59 4f4d2cd09 e56c56cb aa8aacac 12df01bb5 7416fe	1.16
fcdb4675291 b878fb46b56 0c25677fdbb 8160809699b f234ab35ef71 6a7224af	tb1qycc nsuj9fu vgv9da 4y6hxx 2dadcrh g60m8z vu3	tb1qfay 3y498g 79eah7 0zhpq4 u80fxp6 dwavsp ew5x	200	304402201a1df1d86455 d0f63c0e03eef43b2fb15 a213872dfd4a1172da68 c3b5996621602204f73e 92c8ae416ed6f8a8bb21 55851b6e710ed72ee0ec 8d4ffe1464b6b5aa7f6001 02abcb31bb2546eb5b6e 67ae49ed0c21cd575edd b909e804b6cb91b62686 8cf10e	OP_PUSHB YTES_20 2631387245 4f188615bda 93573214de b703ba34f	OP_PUSH BYTES_20 4f491254a 7478b9edf cf15c20af0 ef4983a6b bac	00144f491 254a7478 b9edfcf15c 20af0ef49 83a6bbac	0b9900ee 217b924e 39219d59 4f4d2cd09 e56c56cb aa8aacac 12df01bb5 7416fe	1.23
94c2c53f3d5a 2892b8474a7 729e382a4af 35d5fba515d 715b502bd0b 94ebd397	tb1qycc nsuj9fu vgv9da 4y6hxx 2dadcrh g60m8z vu3	tb1qfay 3y498g 79eah7 0zhpq4 u80fxp6 dwavsp ew5x	200	304402203235bc684a7b c02d5985f0608abfde936 4a48f0cc93edaa1f69057 1ce25f43ad02205d0049 02e6700e974e3f7005f55 df949257df614be921c24 8395b0570036cc9901 02abcb31bb2546eb5b6e 67ae49ed0c21cd575edd b909e804b6cb91b62686 8cf10e	OP_PUSHB YTES_20 2631387245 4f188615bda 93573214de b703ba34f	OP_PUSH BYTES_20 4f491254a 7478b9edf cf15c20af0 ef4983a6b bac	00144f491 254a7478 b9edfcf15c 20af0ef49 83a6bbac	0b9900ee 217b924e 39219d59 4f4d2cd09 e56c56cb aa8aacac 12df01bb5 7416fe	1.21

