

HACKEN

SMART CONTRACT CODE REVIEW AND SECURITY ANALYSIS REPORT

Customer: Dexalot
Date: May 23rd, 2023

This report may contain confidential information about IT systems and the intellectual property of the Customer, as well as information about potential vulnerabilities and methods of their exploitation.

The report can be disclosed publicly after prior consent by another Party. Any subsequent publication of this report shall be without mandatory consent.

Document

Name	Smart Contract Code Review and Security Analysis Report for Dexalot
Approved By	Noah Jelich Lead Solidity SC Auditor at Hacken OU
Type	ERC20 token; on-chain exchange
Platform	Avalanche
Language	Solidity
Methodology	Link
Website	https://dexalot.com
Changelog	23.11.2022 - Initial Review 27.12.2022 - Second Review 30.12.2022 - Third Review 10.01.2023 - Fourth Review 19.01.2023 - Fifth Review 22.02.2023 - Sixth Review 03.03.2023 - Seventh Review 23.05.2023 - Eighth Review



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Introduction

Hacken OÜ (Consultant) was contracted by Dexalot (Customer) to conduct a Smart Contract Code Review and Security Analysis. This report presents the findings of the security assessment of the Customer's smart contracts.

Scope

The scope of the project consists of a review and security analysis of smart contracts in the repository:

Initial review scope

Repository	https://github.com/Dexalot/contracts
Commit	c9c806c909e0d4d2cf723914206c889e59ec2caf
Whitepaper	Link
Functional Requirements	-
Technical Requirements	Link
Contracts Addresses	-
Contracts	<p>File: ./contracts/bridgeApps/LzApp.sol SHA3: 2fca0e10f2d8ebf34a551a83808884d87985d398d745e61cf0c7a1dbee66c315</p> <p>File: ./contracts/DexalotSubnetBalances.sol SHA3: a839e1f3ceda7e4060bd58c66c03c10542e9f7fef656d954207e2b7df9c1f9a2</p> <p>File: ./contracts/Exchange.sol SHA3: 550ebf91e6f22fb2313f23067f88376766454a6dc3af6d70e31d0b1c88db1f9c</p> <p>File: ./contracts/ExchangeMain.sol SHA3: 178e2a31337b9360ece798c1ed5c11fd3663c8e0e1f0aa6e16f5aeb5dc0af5fa</p> <p>File: ./contracts/ExchangeSub.sol SHA3: 3a2ee57626eda5025a86d9f4c0995c8af38522202486832425b2511fbd8e61fc</p> <p>File: ./contracts/GasStation.sol SHA3: 5c5e302ed3d68cbd8bc6d3784e29757328d391995945bd7311f20b2637ec757c</p> <p>File: ./contracts/interfaces/IGasStation.sol SHA3: ee7e2a9630531863f69655fcc81423b2d7fd77d6afb59d4ef1d692e26742c89f</p> <p>File: ./contracts/interfaces/INativeMinter.sol SHA3: c908468fcfb75537ab31e2e9228de06858521fd4788d6fd63934743acec3f028</p>

<p>File: ./contracts/interfaces/IPortfolio.sol SHA3: f20f67f62f6e31ff36c9f58301083bc97da89db1036cd0e79940724e662daf02</p> <p>File: ./contracts/interfaces/IPortfolioBridge.sol SHA3: 9eb762559817b418c2b34c052653ac94b297dfcef06d4c03a216be29d6ec9b6d</p> <p>File: ./contracts/interfaces/IPortfolioMinter.sol SHA3: cf98e4c727d3b316a11d403fa03d5fb47805a4f1cc796722a694cfadadc9f341</p> <p>File: ./contracts/interfaces/ITradePairs.sol SHA3: e6b68dc6db499079377de1b049f38a8364dbc30eeabe2459fb4e503b0bf72d6a</p> <p>File: ./contracts/interfaces/layerZero/ILayerZeroEndpoint.sol SHA3: 371010d107f33cb95c89bdcdb146a4926460a5d0e5e293ed8eb686dc382661f46</p> <p>File: ./contracts/interfaces/layerZero/ILayerZeroReceiver.sol SHA3: 14ac55f1f84ae31204768bb17398725ab29f24a7e507630e7da65db5b43dc584</p> <p>File: ./contracts/interfaces/layerZero/ILayerZeroUserApplicationConfig .sol SHA3: 7a75ffa592bcb4902a573d5b3ddf8faef41650d68f7d92990eac942a70f92a4</p> <p>File: ./contracts/library/Bytes32LinkedListLibrary.sol SHA3: 2e4119c6a6f159755c7323324b5e9b2a64d00316267fca1d14f3748a1af881ca</p> <p>File: ./contracts/library/RBTLibrary.sol SHA3: 5ed8a152c203b10a0892e32d7c32263035c03b366da444775c3a80c11eaf70bf</p> <p>File: ./contracts/library/UtilsLibrary.sol SHA3: c9d01f25d73b36ee1ba28a173ad21073f3c584d2b234b4502de56b7fc9c78dcc</p> <p>File: ./contracts/OrderBooks.sol SHA3: bc7fba1377bc6816f522de7b5ccc9ddb120ffc5064cdf5302f6dbf4ff582b24c</p> <p>File: ./contracts/Portfolio.sol SHA3: 55b546b5687a104ef99acdeeb7ff48dc1928c92ac9fa0ee178fc3756feb8db8d</p> <p>File: ./contracts/PortfolioBridge.sol SHA3: e071e1cce38ca62a4a9a9fc2b2e42e86cda269138cc0d724fed8af7a1fa984ba</p> <p>File: ./contracts/PortfolioBridgeSub.sol SHA3: 59b3218c2c36e6b139fbcccc17f7bba53ddc0133d174027983c2af3cd0828707</p> <p>File: ./contracts/PortfolioMain.sol</p>
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	<p>SHA3: 2ac70f5132b90608cd4923c5482047ac06c1d312c89a955b6cb563b31c1b8e59</p> <p>File: ./contracts/PortfolioMinter.sol SHA3: 002ea8ea4a596a619d23fb73588dd801f874c7881792adfd845ba039651cba35</p> <p>File: ./contracts/PortfolioSub.sol SHA3: 13d7ba767c63f9863160bb86c8a320b5aeaafb319c5147b789bcfd47a3fe2232</p> <p>File: ./contracts/token/IncentiveDistributor.sol SHA3: ba414cb696e9ae9aaa3e3a5f138855f8747f811b8202315c94021c94a07f7932</p> <p>File: ./contracts/TradePairs.sol SHA3: 64caa52f99b2b5cbce16e346045b0e8c7f5c9b09be650cce2c105dd3add00c13</p>
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Second review scope

Repository	https://github.com/Dexalot/contracts
Commit	807f523
Whitepaper	Link
Functional Requirements	-
Technical Requirements	Link
Contracts Addresses	-
Contracts	<p>File: ./contracts/bridgeApps/LzApp.sol SHA3: 7c4800735282756222669dcd28af63c00c1e4b2dcb870b3d7d16b7f22424fffb7</p> <p>File: ./contracts/DexalotSubnetBalances.sol SHA3: 6852c53bdeeb8ca8b235cb2191c02a98ec3f5360b84b0e539668b6e24ae8f912</p> <p>File: ./contracts/Exchange.sol SHA3: 49c02ce260ac3447986004444399ee1745a391d340bbff7217a2a12e14e12e03</p> <p>File: ./contracts/ExchangeMain.sol SHA3: 8f8eefe1e432e188c13737c616f24fd786b96b83e9ec89a6f422eb9a4dfae675</p> <p>File: ./contracts/ExchangeSub.sol SHA3: ab9a1cfb3c34c44583fbb1c69b353a1d172be8238f0515b40660b43ac75c43c8</p> <p>File: ./contracts/GasStation.sol SHA3: 5d2de02da70e116496c57467f4a642c0e4efddc134b05602734903a1b3f1bf42</p> <p>File: ./contracts/interfaces/IGasStation.sol</p>

	<p>SHA3: dfd84fed1e22f38b1187be7c2969fa73e1f650051dc551265c1d910b005a4ecd</p> <p>File: ./contracts/interfaces/INativeMinter.sol SHA3: 79d381f48d7acc73b37bd5348ce7df0531b9f4832a408a5084362fc94b6d4768</p> <p>File: ./contracts/interfaces/IPortfolio.sol SHA3: 3b41a3f31ab77a082e5155c68719fe0de56cb827fa247986a5e531058a17fb93</p> <p>File: ./contracts/interfaces/IPortfolioBridge.sol SHA3: be503016e6e2fd41bcdd0cdc5728260108e5fce32377a806a28dff309c7ec061</p> <p>File: ./contracts/interfaces/IPortfolioBridgeSub.sol SHA3: 3da0244eb221fa10ba30de79600ef705614def416a28d6884278cd771f507afc</p> <p>File: ./contracts/interfaces/IPortfolioMain.sol SHA3: 5152c35b35b029678c2ec1e3e5b75bfe0f2232a740a0ce2f89501e5f716f5713</p> <p>File: ./contracts/interfaces/IPortfolioMinter.sol SHA3: a09113c195a341f4b8d4b5d0ebfa3c064a7ba68c35930adb52c650297682ec80</p> <p>File: ./contracts/interfaces/IPortfolioSub.sol SHA3: b4c8d547c989c61ed7b5ad66f52848b82ed1ceea678af59787b86a80b7929ab0</p> <p>File: ./contracts/interfaces/ITradePairs.sol SHA3: 326f0067e764d8750fc0c6d98bf52a2ba1298aa242c41b48463e93d7e14b3149</p> <p>File: ./contracts/interfaces/layerZero/ILayerZeroEndpoint.sol SHA3: 77bc094bd019313e1aaa48bcd3699d2db4af174e496f1deaf9c99f0d511e570b</p> <p>File: ./contracts/interfaces/layerZero/ILayerZeroReceiver.sol SHA3: 62c575ff041db59d1e1c8eea84ed441cd86dddc9546c4284affed1da9710b5bf</p> <p>File: ./contracts/interfaces/layerZero/ILayerZeroUserApplicationConfig .sol SHA3: 6864f31c800af55316e156a34ecfef7612b75cf5b1d218c6dc11afd81e667c05</p> <p>File: ./contracts/library/Bytes32LinkedListLibrary.sol SHA3: 8a0c8c402f983a350c6b3f00c3a3c67e558caafda0823d4e7946e1d708fcff89</p> <p>File: ./contracts/library/RBTLibrary.sol SHA3: 1d75d91f8b4b5ef92a9d69cbbd1706b03fd0e46b1d94f01cbf8eaf1a3249f546</p> <p>File: ./contracts/library/UtilsLibrary.sol</p>
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	<p>SHA3: eece78d6abfa1a7f84841f4fd7cbb028f3635c933ae166842619c6d51f601591</p> <p>File: ./contracts/OrderBooks.sol SHA3: 90fc3c23394cc9623c407f315015c79bb16c861ca955f93a43e378b48c31b465</p> <p>File: ./contracts/Portfolio.sol SHA3: 47af12ba5419c7ef10546b3bf1d19aeb221744e573dfbcd3091a4ddff18d2841</p> <p>File: ./contracts/PortfolioBridge.sol SHA3: fab4148347c428aa74beffcb86a215a524957b7b2345c546d3f30cc07d915f0f</p> <p>File: ./contracts/PortfolioBridgeSub.sol SHA3: cf04dbdbf2e98c5e3064c00569ffe0127e1d853f525e807b1bf16cebbc2c972d</p> <p>File: ./contracts/PortfolioMain.sol SHA3: 43faea5999cf5b6cd70a15515bea3a0889ff1a8e72a8035a839abf54ef994f2b</p> <p>File: ./contracts/PortfolioMinter.sol SHA3: ecb526ba2f6875ced91da0af4713ea11f2a2e12807822cffe7433dae38ee5686</p> <p>File: ./contracts/PortfolioSub.sol SHA3: 0a374a319d83ac6fd0e6ead905b627f65aaf1d0e9cd83d9fefc862d6af81846a</p> <p>File: ./contracts/token/IncentiveDistributor.sol SHA3: 3f56d96740e2426b04368a9f1621db55af41b84f5b79ffbb4467e8221661a869</p> <p>File: ./contracts/TradePairs.sol SHA3: 13627aa758449f59716c2fbce6f9654d570c455acbe0fae087780f8b53b91f92</p>
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Third review scope

Repository	https://github.com/Dexalot/contracts
Commit	89d40a8aa3072dd9f21a13d41b6743a6fceec9dc
Whitepaper	Link
Functional Requirements	Link
Technical Requirements	Link
Contracts Addresses	-
Contracts	<p>File: ./contracts/bridgeApps/LzApp.sol SHA3: 07f92cdcd8e2ac0c2b663c94979168a79d716d94e7c8778d80ad1ce0072db1a9</p> <p>File: ./contracts/Exchange.sol</p>



	<p>SHA3: 08a7a8918d272cdb0e2ff7b5eb025e24921aaa438144b6a8e838cfc3d09e613f</p> <p>File: ./contracts/ExchangeMain.sol SHA3: c63bc138e1dd103bff1afcadfe9c3640c9bef888838c361642795f6fc67657fa</p> <p>File: ./contracts/ExchangeSub.sol SHA3: 7857feca5814330d72f3f10b36c3e3904d79f41a1753641bd337879f2add367b</p> <p>File: ./contracts/GasStation.sol SHA3: 3f11290468a8f7165c8eafabf5e502c59940cd1efd2038205c41514c03d68b00</p> <p>File: ./contracts/interfaces/IGasStation.sol SHA3: dfd84fed1e22f38b1187be7c2969fa73e1f650051dc551265c1d910b005a4ecd</p> <p>File: ./contracts/interfaces/INativeMinter.sol SHA3: 79d381f48d7acc73b37bd5348ce7df0531b9f4832a408a5084362fc94b6d4768</p> <p>File: ./contracts/interfaces/IPortfolio.sol SHA3: def6219eaa017baf74b444246765e4c3898925ecc09cce7dac28a4bb01c3009b</p> <p>File: ./contracts/interfaces/IPortfolioBridge.sol SHA3: 7cb1538d2bb8af1313962e3ef619a11a46cb8e838c6909c88102d7db87473489</p> <p>File: ./contracts/interfaces/IPortfolioBridgeSub.sol SHA3: 3da0244eb221fa10ba30de79600ef705614def416a28d6884278cd771f507afc</p> <p>File: ./contracts/interfaces/IPortfolioMain.sol SHA3: 5152c35b35b029678c2ec1e3e5b75bfe0f2232a740a0ce2f89501e5f716f5713</p> <p>File: ./contracts/interfaces/IPortfolioMinter.sol SHA3: a09113c195a341f4b8d4b5d0ebfa3c064a7ba68c35930adb52c650297682ec80</p> <p>File: ./contracts/interfaces/IPortfolioSub.sol SHA3: 243c1d8b4b0cde2c3d1ea5e4ecc43701e264f8d4dc268786d85f13607268ec23</p> <p>File: ./contracts/interfaces/ITradePairs.sol SHA3: 25f04da14144a0f7ce759479761fe0141e00f782cc056954845723eacc2bb9f8</p> <p>File: ./contracts/interfaces/layerZero/ILayerZeroEndpoint.sol SHA3: 77bc094bd019313e1aaa48bcd3699d2db4af174e496f1deaf9c99f0d511e570b</p> <p>File: ./contracts/interfaces/layerZero/ILayerZeroReceiver.sol SHA3: 62c575ff041db59d1e1c8eea84ed441cd86dddc9546c4284affed1da9710b5bf</p>
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	<p>File: ./contracts/interfaces/layerZero/ILayerZeroUserApplicationConfig.sol SHA3: 6864f31c800af55316e156a34ecfef7612b75cf5b1d218c6dc11afd81e667c05</p> <p>File: ./contracts/OrderBooks.sol SHA3: 660f3cdf1d404b5825d818fb32471f182ff05a9c4d88ac7a7fee453f4adec3d7</p> <p>File: ./contracts/Portfolio.sol SHA3: 2eede1b67e16bc98865f1250d376f16de5354f008424098a8bb7b354e5e3e90a</p> <p>File: ./contracts/PortfolioBridge.sol SHA3: f495fcb2ff5fe549043f705e51e5e319b8931892d51d39244325b877987c2967</p> <p>File: ./contracts/PortfolioBridgeSub.sol SHA3: 2b4311a0dc7fa43e0069a6c775a8d7f7e144af357fc92ee52e07a9e28f7096fb</p> <p>File: ./contracts/PortfolioMain.sol SHA3: 3d56add857a1b15fbd4d6e2e2d0b42d07a431b9cf158bb9f46d3198b9371a052</p> <p>File: ./contracts/PortfolioMinter.sol SHA3: ecb526ba2f6875ced91da0af4713ea11f2a2e12807822cffe7433dae38ee5686</p> <p>File: ./contracts/PortfolioSub.sol SHA3: 9fc47fc7c39b02e87a8e3e4474597d869624bd79ebf5753e639697e8ffc081dd</p> <p>File: ./contracts/token/IncentiveDistributor.sol SHA3: 3f56d96740e2426b04368a9f1621db55af41b84f5b79ffbb4467e8221661a869</p> <p>File: ./contracts/TradePairs.sol SHA3: 554d8ce21754e6952449f468fc4d71f9fbc7b3849a680d383c0544c1964b2066</p>
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Fourth review scope

Repository	https://github.com/Dexalot/contracts
Commit	4c8e033e01a3f3b1589739ef906f49047c3966b4
Whitepaper	Link
Functional Requirements	-
Technical Requirements	Link
Contracts Addresses	-
Contracts	File: ./contracts/bridgeApps/LzApp.sol

	<p>SHA3: 07f92cdcd8e2ac0c2b663c94979168a79d716d94e7c8778d80ad1ce0072db1a9</p> <p>File: ./contracts/Exchange.sol SHA3: 08a7a8918d272cdb0e2ff7b5eb025e24921aaa438144b6a8e838cfc3d09e613f</p> <p>File: ./contracts/ExchangeMain.sol SHA3: c63bc138e1dd103bff1afcadfe9c3640c9bef888838c361642795f6fc67657fa</p> <p>File: ./contracts/ExchangeSub.sol SHA3: 7857feca5814330d72f3f10b36c3e3904d79f41a1753641bd337879f2add367b</p> <p>File: ./contracts/GasStation.sol SHA3: 3f11290468a8f7165c8eafabf5e502c59940cd1efd2038205c41514c03d68b00</p> <p>File: ./contracts/interfaces/IGasStation.sol SHA3: dfd84fed1e22f38b1187be7c2969fa73e1f650051dc551265c1d910b005a4ecd</p> <p>File: ./contracts/interfaces/INativeMinter.sol SHA3: 79d381f48d7acc73b37bd5348ce7df0531b9f4832a408a5084362fc94b6d4768</p> <p>File: ./contracts/interfaces/IPortfolio.sol SHA3: b0712cf2171fc305bff339304cbc944001452192431fc3cbb467625f8123c6cb</p> <p>File: ./contracts/interfaces/IPortfolioBridge.sol SHA3: 7cb1538d2bb8af1313962e3ef619a11a46cb8e838c6909c88102d7db87473489</p> <p>File: ./contracts/interfaces/IPortfolioBridgeSub.sol SHA3: 3da0244eb221fa10ba30de79600ef705614def416a28d6884278cd771f507afc</p> <p>File: ./contracts/interfaces/IPortfolioMain.sol SHA3: 5152c35b35b029678c2ec1e3e5b75bfe0f2232a740a0ce2f89501e5f716f5713</p> <p>File: ./contracts/interfaces/IPortfolioMinter.sol SHA3: a09113c195a341f4b8d4b5d0ebfa3c064a7ba68c35930adb52c650297682ec80</p> <p>File: ./contracts/interfaces/IPortfolioSub.sol SHA3: 243c1d8b4b0cde2c3d1ea5e4ecc43701e264f8d4dc268786d85f13607268ec23</p> <p>File: ./contracts/interfaces/ITradePairs.sol SHA3: 25f04da14144a0f7ce759479761fe0141e00f782cc056954845723eacc2bb9f8</p> <p>File: ./contracts/interfaces/layerZero/ILayerZeroEndpoint.sol SHA3: 77bc094bd019313e1aaa48bcd3699d2db4af174e496f1deaf9c99f0d511e570b</p>
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File: ./contracts/library/Bytes32LinkedListLibrary.sol SHA3: e798302aecc7346b0e2a5cbc7632b3fa11a9ea5263012951639e5453cf738eec
File: ./contracts/library/RBTLibrary.sol SHA3: 800295acffd379ca0497ff58e6fe37e7b07f778d9b25e623bdd298e29496a082
File: ./contracts/library/UtilsLibrary.sol SHA3: 02fa557c9158493d4fe5f991d61834ee3cf63f9980aaac1ebc19598b3cfb687c
File: ./contracts/OrderBooks.sol SHA3: 871bedf29e3b81e8bcba65eb9550b243f16e0275759b93e5abd75ec6d98e8eb1
File: ./contracts/Portfolio.sol SHA3: 2eede1b67e16bc98865f1250d376f16de5354f008424098a8bb7b354e5e3e90a
File: ./contracts/PortfolioBridge.sol SHA3: f495fcb2ff5fe549043f705e51e5e319b8931892d51d39244325b877987c2967
File: ./contracts/PortfolioBridgeSub.sol SHA3: eb66a3acbb15132d48173b15a02486f45f8a339f7bff49b52344d3d3453d45a7
File: ./contracts/PortfolioMain.sol SHA3: 3d56add857a1b15fbd4d6e2e2d0b42d07a431b9cf158bb9f46d3198b9371a052
File: ./contracts/PortfolioMinter.sol SHA3: ecb526ba2f6875ced91da0af4713ea11f2a2e12807822cffe7433dae38ee5686
File: ./contracts/PortfolioSub.sol SHA3: 1e626f3cda3618a87773ace3fd66f8bd7a1d186d1dd21b4f4130332df7b610c8
File: ./contracts/token/IncentiveDistributor.sol SHA3: 3f56d96740e2426b04368a9f1621db55af41b84f5b79ffbb4467e8221661a869
File: ./contracts/TradePairs.sol SHA3: 6630bad7915e0676670d8bfa1be4cc70be7b4b3897974207659c2448aef1586c

Fifth review scope

Repository	https://github.com/Dexalot/contracts
Commit	91b2b26ffe8cdc9b5411836621465db6d4299ed0
Whitepaper	Link
Functional Requirements	-
Technical Requirements	Link

Contracts Addresses	-
Contracts	<p>File: ./contracts/bridgeApps/LzApp.sol SHA3: 07f92cdcd8e2ac0c2b663c94979168a79d716d94e7c8778d80ad1ce0072db1a9</p> <p>File: ./contracts/Exchange.sol SHA3: 08a7a8918d272cdb0e2ff7b5eb025e24921aaa438144b6a8e838cfc3d09e613f</p> <p>File: ./contracts/ExchangeMain.sol SHA3: c63bc138e1dd103bff1afcadfe9c3640c9bef888838c361642795f6fc67657fa</p> <p>File: ./contracts/ExchangeSub.sol SHA3: be80796088b9e50708dbd8758f1a86bfd4b368848f7d41525b036897b76998c6</p> <p>File: ./contracts/GasStation.sol SHA3: 3f11290468a8f7165c8eafabf5e502c59940cd1efd2038205c41514c03d68b00</p> <p>File: ./contracts/interfaces/IGasStation.sol SHA3: dfd84fed1e22f38b1187be7c2969fa73e1f650051dc551265c1d910b005a4ecd</p> <p>File: ./contracts/interfaces/INativeMinter.sol SHA3: 79d381f48d7acc73b37bd5348ce7df0531b9f4832a408a5084362fc94b6d4768</p> <p>File: ./contracts/interfaces/IPortfolio.sol SHA3: b0712cf2171fc305bff339304cbc944001452192431fc3cbb467625f8123c6cb</p> <p>File: ./contracts/interfaces/IPortfolioBridge.sol SHA3: 7cb1538d2bb8af1313962e3ef619a11a46cb8e838c6909c88102d7db87473489</p> <p>File: ./contracts/interfaces/IPortfolioBridgeSub.sol SHA3: 3da0244eb221fa10ba30de79600ef705614def416a28d6884278cd771f507afc</p> <p>File: ./contracts/interfaces/IPortfolioMain.sol SHA3: 5152c35b35b029678c2ec1e3e5b75bfe0f2232a740a0ce2f89501e5f716f5713</p> <p>File: ./contracts/interfaces/IPortfolioMinter.sol SHA3: a09113c195a341f4b8d4b5d0ebfa3c064a7ba68c35930adb52c650297682ec80</p> <p>File: ./contracts/interfaces/IPortfolioSub.sol SHA3: 243c1d8b4b0cde2c3d1ea5e4ecc43701e264f8d4dc268786d85f13607268ec23</p> <p>File: ./contracts/interfaces/ITradePairs.sol SHA3: 5f4317d54e41348435360680d3019e575f90479e41c53121612a9971022bc8a8</p> <p>File: ./contracts/interfaces/layerZero/ILayerZeroEndpoint.sol</p>

<p>SHA3: 77bc094bd019313e1aaa48bcd3699d2db4af174e496f1deaf9c99f0d511e570b</p> <p>File: ./contracts/library/Bytes32LinkedListLibrary.sol SHA3: e798302aecc7346b0e2a5cbc7632b3fa11a9ea5263012951639e5453cf738eec</p> <p>File: ./contracts/library/RBTLibrary.sol SHA3: 800295acffd379ca0497ff58e6fe37e7b07f778d9b25e623bdd298e29496a082</p> <p>File: ./contracts/library/UtilsLibrary.sol SHA3: 02fa557c9158493d4fe5f991d61834ee3cf63f9980aac1ebc19598b3cfb687c</p> <p>File: ./contracts/OrderBooks.sol SHA3: 871bedf29e3b81e8bcba65eb9550b243f16e0275759b93e5abd75ec6d98e8eb1</p> <p>File: ./contracts/Portfolio.sol SHA3: 2eede1b67e16bc98865f1250d376f16de5354f008424098a8bb7b354e5e3e90a</p> <p>File: ./contracts/PortfolioBridge.sol SHA3: f495fcb2ff5fe549043f705e51e5e319b8931892d51d39244325b877987c2967</p> <p>File: ./contracts/PortfolioBridgeSub.sol SHA3: eb66a3acbb15132d48173b15a02486f45f8a339f7bff49b52344d3d3453d45a7</p> <p>File: ./contracts/PortfolioMain.sol SHA3: 3d56add857a1b15fbd4d6e2e2d0b42d07a431b9cf158bb9f46d3198b9371a052</p> <p>File: ./contracts/PortfolioMinter.sol SHA3: ecb526ba2f6875ced91da0af4713ea11f2a2e12807822cffe7433dae38ee5686</p> <p>File: ./contracts/PortfolioSub.sol SHA3: aab6f2864dd9b802c6ca0cd2c352b7c98eb1bbc13b3a9776d9bd838b24c5c063</p> <p>File: ./contracts/TradePairs.sol SHA3: 444abc620fc54433fb58e46dbeacc1cfa84eb3c9ac437c5b85e0ba978a0cb869</p>

Sixth review scope

Repository	https://github.com/Dexalot/contracts
Commit	74b00962e90452c23bbfdd677ffb987d1a0148c2
Whitepaper	Link
Functional Requirements	-
Technical Requirements	Link

Contracts Addresses	-
Contracts	<p>File: ./contracts/BannedAccounts.sol SHA3: 865ed518db1bea4eff01eba833f419a6ced057a32f2ea070a270e4a5c5f2d454</p> <p>File: ./contracts/bridgeApps/LzApp.sol SHA3: 07f92cdcd8e2ac0c2b663c94979168a79d716d94e7c8778d80ad1ce0072db1a9</p> <p>File: ./contracts/Exchange.sol SHA3: 08a7a8918d272cdb0e2ff7b5eb025e24921aaa438144b6a8e838cfc3d09e613f</p> <p>File: ./contracts/ExchangeMain.sol SHA3: c63bc138e1dd103bff1afcadfe9c3640c9bef888838c361642795f6fc67657fa</p> <p>File: ./contracts/ExchangeSub.sol SHA3: be80796088b9e50708dbd8758f1a86bfd4b368848f7d41525b036897b76998c6</p> <p>File: ./contracts/GasStation.sol SHA3: 3f11290468a8f7165c8eafabf5e502c59940cd1efd2038205c41514c03d68b00</p> <p>File: ./contracts/interfaces/IBannedAccounts.sol SHA3: c1bf899bee0c1eb93ac678f287f22d3d7775db9f5844ddbaa44ec127cf259b62</p> <p>File: ./contracts/interfaces/IGasStation.sol SHA3: dfd84fed1e22f38b1187be7c2969fa73e1f650051dc551265c1d910b005a4ecd</p> <p>File: ./contracts/interfaces/INativeMinter.sol SHA3: 79d381f48d7acc73b37bd5348ce7df0531b9f4832a408a5084362fc94b6d4768</p> <p>File: ./contracts/interfaces/IPortfolio.sol SHA3: a20e93bf386e81ba18acf1cf549e3445e45be621702253309273eaf71bbe7b59</p> <p>File: ./contracts/interfaces/IPortfolioBridge.sol SHA3: 7cb1538d2bb8af1313962e3ef619a11a46cb8e838c6909c88102d7db87473489</p> <p>File: ./contracts/interfaces/IPortfolioBridgeSub.sol SHA3: 3da0244eb221fa10ba30de79600ef705614def416a28d6884278cd771f507afc</p> <p>File: ./contracts/interfaces/IPortfolioMain.sol SHA3: 5152c35b35b029678c2ec1e3e5b75bfe0f2232a740a0ce2f89501e5f716f5713</p> <p>File: ./contracts/interfaces/IPortfolioMinter.sol SHA3: a09113c195a341f4b8d4b5d0ebfa3c064a7ba68c35930adb52c650297682ec80</p> <p>File: ./contracts/interfaces/IPortfolioSub.sol</p>

	<p>SHA3: be9ad9a60d50c44b9e333157e263db5273d8a67f25cd712a63f0adde9d701586</p> <p>File: ./contracts/interfaces/ITradePairs.sol SHA3: d859ac206e55e71dcbf4f992cc066f1df5247f9a40f09c017bd34e956a4a7e7c</p> <p>File: ./contracts/interfaces/layerZero/ILayerZeroEndpoint.sol SHA3: 77bc094bd019313e1aaa48bcd3699d2db4af174e496f1deaf9c99f0d511e570b</p> <p>File: ./contracts/interfaces/layerZero/ILayerZeroReceiver.sol SHA3: 62c575ff041db59d1e1c8eea84ed441cd86dddc9546c4284affed1da9710b5bf</p> <p>File: ./contracts/interfaces/layerZero/ILayerZeroUserApplicationConfig .sol SHA3: 6864f31c800af55316e156a34ecfef7612b75cf5b1d218c6dc11afd81e667c05</p> <p>File: ./contracts/library/Bytes32LinkedListLibrary.sol SHA3: e798302aecc7346b0e2a5cbc7632b3fa11a9ea5263012951639e5453cf738eec</p> <p>File: ./contracts/library/RBTLibrary.sol SHA3: 800295acffd379ca0497ff58e6fe37e7b07f778d9b25e623bdd298e29496a082</p> <p>File: ./contracts/library/UtilsLibrary.sol SHA3: 87c22b520f3d361237c016bdd8fd28e6ede5aa4dd6c597addc20611fc90f47e3</p> <p>File: ./contracts/OrderBooks.sol SHA3: 739d71e78d52de9fe02fc88292f9c14db444dd371f84ee3fe52d38f19b12fe3f</p> <p>File: ./contracts/Portfolio.sol SHA3: 5feb565f29802ba0adc604c9b5f39d485278fda204fbceadd80e0f0fb7396b3</p> <p>File: ./contracts/PortfolioBridge.sol SHA3: 58f113ffac963a25c34d02f30e7e26577914177a414d4d5d023153713c2b6e83</p> <p>File: ./contracts/PortfolioBridgeSub.sol SHA3: f1b718a52efd9de8ca3bd515640312888c57693868db092766e5a8fe8851b091</p> <p>File: ./contracts/PortfolioMain.sol SHA3: c8c382d3434878bf8483d8a50fc28e5e72bd7ca184f4f80cf6b54ed5204dd5b7</p> <p>File: ./contracts/PortfolioMinter.sol SHA3: ecb526ba2f6875ced91da0af4713ea11f2a2e12807822cffe7433dae38ee5686</p> <p>File: ./contracts/PortfolioSub.sol</p>
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	<p>SHA3: 0c5c83ba4718b3147c7d0c02d5f324bb6b408b0f1059bc5d3cf5cc4d4da5154c</p> <p>File: ./contracts/token/IncentiveDistributor.sol SHA3: 69601926e4d3542c5b9c4831357f9fcd59012d8288a579923011c8c3777ea0ea</p> <p>File: ./contracts/TradePairs.sol SHA3: fa5c1cbe0780134de4cd8a66aa7cd2937705333ba56f9ba8183bec433378dca9</p>
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Seventh review scope

Repository	https://github.com/Dexalot/contracts
Commit	1ec4b732b06dd2a25fe666cfde5b619af5b6f20b
Whitepaper	Link
Functional Requirements	-
Technical Requirements	Link
Contracts Addresses	-
Contracts	<p>File: ./contracts/BannedAccounts.sol SHA3: 865ed518db1bea4eff01eba833f419a6ced057a32f2ea070a270e4a5c5f2d454</p> <p>File: ./contracts/bridgeApps/LzApp.sol SHA3: 07f92cdcd8e2ac0c2b663c94979168a79d716d94e7c8778d80ad1ce0072db1a9</p> <p>File: ./contracts/Exchange.sol SHA3: 08a7a8918d272cdb0e2ff7b5eb025e24921aaa438144b6a8e838cfc3d09e613f</p> <p>File: ./contracts/ExchangeMain.sol SHA3: c63bc138e1dd103bff1afcadfe9c3640c9bef888838c361642795f6fc67657fa</p> <p>File: ./contracts/ExchangeSub.sol SHA3: be80796088b9e50708dbd8758f1a86bfd4b368848f7d41525b036897b76998c6</p> <p>File: ./contracts/GasStation.sol SHA3: 3f11290468a8f7165c8eafabf5e502c59940cd1efd2038205c41514c03d68b00</p> <p>File: ./contracts/interfaces/IBannedAccounts.sol SHA3: c1bf899bee0c1eb93ac678f287f22d3d7775db9f5844ddbaa44ec127cf259b62</p> <p>File: ./contracts/interfaces/IGasStation.sol SHA3: dfd84fed1e22f38b1187be7c2969fa73e1f650051dc551265c1d910b005a4ecd</p> <p>File: ./contracts/interfaces/INativeMinter.sol</p>

	<p>SHA3: 79d381f48d7acc73b37bd5348ce7df0531b9f4832a408a5084362fc94b6d4768</p> <p>File: ./contracts/interfaces/IPortfolio.sol SHA3: a20e93bf386e81ba18acf1cf549e3445e45be621702253309273eaf71bbe7b59</p> <p>File: ./contracts/interfaces/IPortfolioBridge.sol SHA3: 7cb1538d2bb8af1313962e3ef619a11a46cb8e838c6909c88102d7db87473489</p> <p>File: ./contracts/interfaces/IPortfolioBridgeSub.sol SHA3: 3da0244eb221fa10ba30de79600ef705614def416a28d6884278cd771f507afc</p> <p>File: ./contracts/interfaces/IPortfolioMain.sol SHA3: 5152c35b35b029678c2ec1e3e5b75bfe0f2232a740a0ce2f89501e5f716f5713</p> <p>File: ./contracts/interfaces/IPortfolioMinter.sol SHA3: a09113c195a341f4b8d4b5d0ebfa3c064a7ba68c35930adb52c650297682ec80</p> <p>File: ./contracts/interfaces/IPortfolioSub.sol SHA3: be9ad9a60d50c44b9e333157e263db5273d8a67f25cd712a63f0adde9d701586</p> <p>File: ./contracts/interfaces/ITradePairs.sol SHA3: aef9e69ba7a93a58f2d3b6174c3a97ee73bcdb2b6c75aaf066c98ef60bfec401</p> <p>File: ./contracts/interfaces/layerZero/ILayerZeroEndpoint.sol SHA3: 77bc094bd019313e1aaa48bcd3699d2db4af174e496f1deaf9c99f0d511e570b</p> <p>File: ./contracts/interfaces/layerZero/ILayerZeroReceiver.sol SHA3: 62c575ff041db59d1e1c8eea84ed441cd86dddc9546c4284affed1da9710b5bf</p> <p>File: ./contracts/interfaces/layerZero/ILayerZeroUserApplicationConfig .sol SHA3: 6864f31c800af55316e156a34ecfef7612b75cf5b1d218c6dc11afd81e667c05</p> <p>File: ./contracts/library/Bytes32LinkedListLibrary.sol SHA3: e798302aacc7346b0e2a5cbc7632b3fa11a9ea5263012951639e5453cf738eec</p> <p>File: ./contracts/library/RBTLibrary.sol SHA3: 800295acffd379ca0497ff58e6fe37e7b07f778d9b25e623bdd298e29496a082</p> <p>File: ./contracts/library/UtilsLibrary.sol SHA3: 87c22b520f3d361237c016bdd8fd28e6ede5aa4dd6c597addc20611fc90f47e3</p> <p>File: ./contracts/OrderBooks.sol</p>
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	<p>SHA3: 739d71e78d52de9fe02fc88292f9c14db444dd371f84ee3fe52d38f19b12fe3f</p> <p>File: ./contracts/Portfolio.sol SHA3: 5feb565f29802ba0adc604c9b5f39d485278fda204fbceadd80e0f0fb7396b3</p> <p>File: ./contracts/PortfolioBridge.sol SHA3: 58f113ffac963a25c34d02f30e7e26577914177a414d4d5d023153713c2b6e83</p> <p>File: ./contracts/PortfolioBridgeSub.sol SHA3: f1b718a52efd9de8ca3bd515640312888c57693868db092766e5a8fe8851b091</p> <p>File: ./contracts/PortfolioMain.sol SHA3: c8c382d3434878bf8483d8a50fc28e5e72bd7ca184f4f80cf6b54ed5204dd5b7</p> <p>File: ./contracts/PortfolioMinter.sol SHA3: ecb526ba2f6875ced91da0af4713ea11f2a2e12807822cffe7433dae38ee5686</p> <p>File: ./contracts/PortfolioSub.sol SHA3: 0c5c83ba4718b3147c7d0c02d5f324bb6b408b0f1059bc5d3cf5cc4d4da5154c</p> <p>File: ./contracts/token/IncentiveDistributor.sol SHA3: 69601926e4d3542c5b9c4831357f9fcd59012d8288a579923011c8c3777ea0ea</p> <p>File: ./contracts/token/Staking.sol SHA3: 77e1ade806a072414a784bf16e05a0f1e0908532deba55aa30ceca224cb1801d</p> <p>File: ./contracts/TradePairs.sol SHA3: 7d118b2f074fcd58ca3bb13025c74fc37ad5ba4652a893adabc7fedc1fe5029d</p>
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Eighth review scope

Repository	https://github.com/Dexalot/contracts
Commit	ab85a832e0a3bda354a8b22b4040553424344a40
Whitepaper	Link
Functional Requirements	Link
Technical Requirements	Link
Contracts Addresses	-
Contracts	<p>File: contracts/token/IncentiveDistributor.sol SHA3: 39d356ca81293853f23b0e16c533739a77752fa000edc3c551d29d947ef0df12</p> <p>File: contracts/PortfolioSub.sol SHA3: 4a1b583b4de89fc269619c77def9d8e139e4bcd61be422e4da9f9f704cc4f2e6</p>

Severity Definitions

Risk Level	Description
Critical	Critical vulnerabilities are usually straightforward to exploit and can lead to assets loss or data manipulations.
High	High-level vulnerabilities are difficult to exploit; however, they also have a significant impact on smart contract execution, e.g., public access to crucial functions.
Medium	Medium-level vulnerabilities are important to fix; however, they cannot lead to assets loss or data manipulations.
Low	Low-level vulnerabilities are mostly related to outdated, unused, etc. code snippets that cannot have a significant impact on execution.

Executive Summary

The score measurement details can be found in the corresponding section of the [scoring methodology](#).

Documentation quality

The total Documentation Quality score is **10** out of **10**.

- Functional requirements are fully provided.
- Technical descriptions of the contracts are sufficient.

Code quality

The total Code Quality score is **9** out of **10**.

- The development environment is well configured, and the code is well documented and covered by tests.
- The code's readability suffers due to contract size limitations that limit potential abstraction.

Test coverage

Test coverage of the project is **95.89%** (branch coverage).

- Deployment and basic user interactions are covered with tests.
- Some test branches are missing in the Bytes32LinkedListLibrary, TradePairs and most Portfolio* contracts.

Security score

As a result of the audit, the code contains no issues. The security score is **10** out of **10**.

All found issues are displayed in the “Findings” section.

Summary

According to the assessment, the Customer's smart contract has the following score: **9.7**.

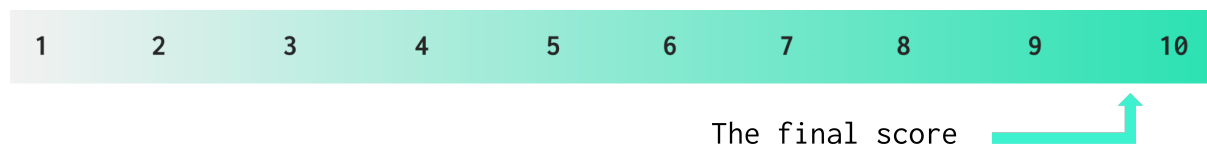


Table. The distribution of issues during the audit

Review date	Low	Medium	High	Critical
23 November 2022	9	8	5	1
26 December 2022	1	2	0	0
30 December 2022	0	0	0	0
10 January 2023	0	0	1	1
19 January 2023	0	0	0	0
22 February 2023	1	0	0	0
03 March 2023	0	0	0	0
23 May 2023	0	0	0	0

Checked Items

We have audited the Customers' smart contracts for commonly known and more specific vulnerabilities. Here are some items considered:

Item	Type	Description	Status
Default Visibility	SWC-100 SWC-108	Functions and state variables visibility should be set explicitly. Visibility levels should be specified consciously.	Passed
Integer Overflow and Underflow	SWC-101	If unchecked math is used, all math operations should be safe from overflows and underflows.	Not Relevant
Outdated Compiler Version	SWC-102	It is recommended to use a recent version of the Solidity compiler.	Passed
Floating Pragma	SWC-103	Contracts should be deployed with the same compiler version and flags that they have been tested thoroughly.	Passed
Unchecked Call Return Value	SWC-104	The return value of a message call should be checked.	Passed
Access Control & Authorization	CWE-284	Ownership takeover should not be possible. All crucial functions should be protected. Users could not affect data that belongs to other users.	Passed
SELFDESTRUCT Instruction	SWC-106	The contract should not be self-destructible while it has funds belonging to users.	Not Relevant

Check-Effect-Interaction	SWC-107	Check-Effect-Interaction pattern should be followed if the code performs ANY external call.	Passed
Assert Violation	SWC-110	Properly functioning code should never reach a failing assert statement.	Passed
Deprecated Solidity Functions	SWC-111	Deprecated built-in functions should never be used.	Passed
Delegatecall to Untrusted Callee	SWC-112	Delegatecalls should only be allowed to trusted addresses.	Not Relevant
DoS (Denial of Service)	SWC-113 SWC-128	Execution of the code should never be blocked by a specific contract state unless required.	Passed
Race Conditions	SWC-114	Race Conditions and Transactions Order Dependency should not be possible.	Passed
Authorization through tx.origin	SWC-115	tx.origin should not be used for authorization.	Passed
Block values as a proxy for time	SWC-116	Block numbers should not be used for time calculations.	Passed
Signature Unique Id	SWC-117 SWC-121 SWC-122 EIP-155	Signed messages should always have a unique id. A transaction hash should not be used as a unique id. Chain identifiers should always be used. All parameters from the signature should be used in signer recovery	Passed
Shadowing State Variable	SWC-119	State variables should not be shadowed.	Passed
Weak Sources of Randomness	SWC-120	Random values should never be generated from Chain Attributes or be predictable.	Not Relevant
Incorrect Inheritance Order	SWC-125	When inheriting multiple contracts, especially if they have identical functions, a developer should carefully specify inheritance in the correct order.	Passed
Calls Only to Trusted Addresses	EEA-Leve1-2 SWC-126	All external calls should be performed only to trusted addresses.	Passed
Presence of unused variables	SWC-131	The code should not contain unused variables if this is not justified by design.	Passed
EIP standards violation	EIP	EIP standards should not be violated.	Passed

Assets integrity	Custom	Funds are protected and cannot be withdrawn without proper permissions.	Passed
User Balances manipulation	Custom	Contract owners or any other third party should not be able to access funds belonging to users.	Passed
Data Consistency	Custom	Smart contract data should be consistent all over the data flow.	Passed
Flashloan Attack	Custom	When working with exchange rates, they should be received from a trusted source and not be vulnerable to short-term rate changes that can be achieved by using flash loans. Oracles should be used.	Not Relevant
Token Supply manipulation	Custom	Tokens can be minted only according to rules specified in a whitepaper or any other documentation provided by the customer.	Not Relevant
Gas Limit and Loops	Custom	Transaction execution costs should not depend dramatically on the amount of data stored on the contract. There should not be any cases when execution fails due to the block Gas limit.	Passed
Style guide violation	Custom	Style guides and best practices should be followed.	Passed
Requirements Compliance	Custom	The code should be compliant with the requirements provided by the Customer.	Passed
Environment Consistency	Custom	The project should contain a configured development environment with a comprehensive description of how to compile, build and deploy the code.	Passed
Secure Oracles Usage	Custom	The code should have the ability to pause specific data feeds that it relies on. This should be done to protect a contract from compromised oracles.	Passed
Tests Coverage	Custom	The code should be covered with unit tests. Test coverage should be 100%, with both negative and positive cases covered. Usage of contracts by multiple users should be tested.	Passed
Stable Imports	Custom	The code should not reference draft contracts, which may be changed in the future.	Passed

System Overview

Dexalot is an on-chain exchange system that manages built-in order book implementation by supporting different ERC20 tokens. The system relies on the following contracts:

- *DexalotSubnetBalances* – a contract that stores the balances as Merkle roots.
- *Exchange* – an abstract management-wrapper contract that offers varying access privileges. It is inherited by the *ExchangeMain* and *ExchangeSub* contracts.
- *ExchangeMain* – a contract that pulls the price feeds from the provided oracle contract address. It has a flipping coin implementation that benefits from the oracle price feed result.
- *ExchangeSub* – a contract that allows the owner to manage the trade pairs and order books.
- *GasStation* – a contract that is used by the *PortfolioSub* contract to swap ERC20 tokens with the subnet's native coin to send users native coins for Gas.
- *OrderBooks* – a contract implementing limit order books with time and price priority.
- *Portfolio* – an abstract contract that manages the bridge provider and its features. It is used by both *PortfolioSub* and *PortfolioMain*.
- *PortfolioMain* – a contract for users to deposit native or ERC20 tokens. Deposited amounts are sent to the portfolio bridge contract.
- *PortfolioSub* – a contract that helps native token deposits and withdrawals and execution of orders between traders.
- *TradePairs* – Implements data structures and functions for trade pairs (e.g. AVAX/USDT).
- *LzApp* – a generic Layer Zero app copied from the LayerZero example contracts.
- *Bytes32LinkedListLibrary* – heavily modified circular FIFO LinkedList implementation.
- *RBTLibrary* – Red-Black Tree binary search library to store and access a sorted list of unsigned integer data. An algorithm rebalances the binary tree, resulting in $O(\log n)$ insert, remove and search times. Modified with Gas optimizations.
- *UtilsLibrary* – common utility functions used in all *Dexalot* contracts.
- *IncentiveDistributor* – a distributor for *Dexalot* incentives that distributes 200k \$ALOT tokens monthly and other tokens based on off-chain calculated usage reports.

Privileged roles

- The admin of the *LzApp* contract can:
 - set the Layer Zero Endpoint address

- set the send/receive message version
- set the Layer Zero trusted remote address
- force resumes the stuck bridge
- retry the stuck message in the bridge
- The owner of the IncentiveDistributor contract can:
 - add a reward token
 - withdraw reward token balances of the contract
 - pause/unpause the contract
- The DEFAULT_ADMIN_ROLE of the Exchange contract can:
 - set the portfolio address
 - add/remove multiple default admin roles
 - add/remove AUCTION_ADMIN_ROLE roles
 - pause/unpause the portfolio contract
 - add/remove trusted contract addresses to/from the portfolio contract
- The AUCTION_ADMIN_ROLE of the Exchange contract can:
 - add new trade token addresses to the portfolio contract
- The ONBEHALF_OF role of the TradePairs contract can:
 - add Orders instead of the _trader
- The DEFAULT_ADMIN_ROLE role of the TradePairs contract can:
 - add trade pairs
 - pause/unpause the contract
 - pause the trade activity for a specific token pair
 - pause adding a new order
 - Set a trade pair as the only post. (No matching)
 - set the auction mode
 - set the min trade amount
 - define order types for the trade pairs
 - set the display decimals of the base or the quote asset
 - set the maker and taker rates
 - set the allowed slippage percent
 - match auction orders
 - cancel orders by starting from the less profit order in the orderbook.
- The admin of the GasStation contract can:
 - set the Gas amount
 - pause/unpause the contract
 - withdraw the native balance.
- The admin of the Portfolio contract can:
 - set the portfolio bridge contract address
 - enable/disable the bridge provider's activity
 - force resume receive action, wiping the existing message
 - retry the stuck message in the LZ bridge
 - revoke admin and bridge roles

- pause/unpause the contract
- set bridge fees and swap amounts
- add and remove trusted contracts
- add and remove tokens
- The admin of the PortfolioMain contract can:
 - recover the LZ payload
 - collect bridge fees (native and ERC20)
- The admin of the PortfolioSub contract shares most functions with the admin of the Portfolio, but can:
 - set up the portfolio bridge contract
 - change bridge providers
- The PORTFOLIO_BRIDGE_ROLE of the PortfolioSub contract can:
 - process DEPOSIT messages since they are the only ones being sent to the portfolio sub
- The PORTFOLIO_BRIDGE_ROLE of the PortfolioMain contract can:
 - process WITHDRAW messages as it is the only message that can be sent to the portfolio main
- The admin of the PortfolioMinter contract can pause/unpause the contract. The minter role can mint native tokens and this privilege must be the Portfolio contract.
- The WRITER_ROLE of the DexalotSubnetBalances can set the Merkle root hashes and public IPFS links that store the user balances in a Merkle tree.
- The ExchangeMain contract is the admin of PortfolioMain.
- The ExchangeSub contract is the admin of PortfolioSub and TradePairs.
- The Exchange contract acts as the AuctionManager using AUCTION_ADMIN_ROLE.
- The admin of the OrderBooks contract can set the trade pair addresses.
- All the functions pertaining to Auction can be called directly in TradePairs and Portfolio using DEFAULT_ADMIN_ROLE but it is not recommended because certain actions require a synchronised update to both Portfolio and TradePairs contracts.
- ExchangeSub needs to have a DEFAULT_ADMIN_ROLE on TradePairs. TradePairs should have an EXECUTOR_ROLE on OrderBooks

Risks

- The code contains **out-of-scope** 3rd party contracts that could not be verified within the scope of the audit. (LayerZeroEndpoint)
- Due to the dual-chain nature of the system, unexpected behavior could arise from the **off-chain out-of-scope** parts of the system responsible for bridging. These could lead to user fund manipulation and losses.
- The system relies on requests received from the bridge. The **reliability and security of the bridge are not verifiable** by the current audit.

Recommendations

- The **DEFAULT_ADMIN_ROLE** role is central to the system. It is recommended that this address is a multisig with at least $\frac{3}{5}$ signatures required where an EOA is set for this role.

Findings

■■■■ Critical

1. Weak Source of Randomness

In the ExchangeMain contract, a coinflip is generated based on the AVAX/USDT market data. The purpose of this is unclear and not used anywhere within the scope.

Using random values that users can affect or predict is not secure because the impact can be used for profit.

Path: ./contracts/bridgeApps/ExchangeMain.sol

Recommendation: The random values should be obtained from external, provably random sources.

Status: **Mitigated** (Revised commit: 807f523b40089ab4aa55cd98398f7eabd963e819) (The issue is mitigated since it is not used in the project. However it is used in the out-of-scope off-chain code.)

2. Incorrect Calculations

When a deposit transaction is done in the processXFerPayload function and if the trader's account needs Gas tokens to be sent and the trader has enough amount in asset[trader][native].available, the Gas amount is not deducted from the tokenTotals although it's deducted from the asset.available and asset.total.

Since there will always be accumulated leftover amounts in tokenTotals, the condition of "tokenTotals[_symbol] == 0" on line 774 is never going to be matched. This will lead to the owner not being able to remove the tokens.

Path: ./contracts/PortfolioSub.sol: processXFerPayload()

Recommendation: Deduct the gasAmount that is sent to the user from the tokenTotals.

Status: **Mitigated** (Revised commit: 91b2b26ffe8cdc9b5411836621465db6d4299ed0) (The Customer stated that it's not an issue as it's a subject only for the native token. Native tokens will never be removed.)

■■■ High

3. Non-Finalized Code

On line 95, `version` number is hardcoded and there are no version options other than "1". Therefore, it has no effect on the implementation.

Path: ./contracts/bridgeApps/LzApp.sol: lzEstimateFees()

Recommendation: Remove the redundant variable or allow the possibility of other versions.

Status: **Mitigated** (Revised commit:
807f523b40089ab4aa55cd98398f7eabd963e819) (The
customer provided documentation in the code that the LayerZero
contract needs v1 in adapterParams to specify higher gas for the
destination to receive a transaction. However, it should be noted
here that the LayerZero contract is not verified.)

4. Denial of Service Vulnerability

If the number of tokens reaches a large enough size, it can cause the *withdrawFees* function to fail due to excessive Gas.

Path: ./contracts/PortfolioSub.sol: withdrawFees

Recommendation: Instead of iterating over all tokens, follow a pull-over-push pattern and perform the withdrawal according to the given token address parameter or limit the number of tokens.

Status: **Fixed** (Revised commit:
807f523b40089ab4aa55cd98398f7eabd963e819)

5. Highly Permissive Role Access

Owners should not have access to funds that belong to users.

The refund functionality can be used to siphon user funds without providing bridge proof.

Path: ./contracts/PortfolioBridge.sol: refundTokens, refundNative

Recommendation: Remove the highly permissive withdrawal functionality.

Status: **Mitigated** (Revised commit:
807f523b40089ab4aa55cd98398f7eabd963e819) (The Customer clarified
that the bridge contract is going to be funded only by the owners.)

6. Highly Permissive Role Access

The admin of the TradePairs contract can cancel pending auction orders without user permission.

This may cause manipulations of orders by the admin privilege.

Path: ./contracts/TradePairs.sol: unsolicitedCancel()

Recommendation: Do not allow the admin to cancel pending orders.

Status: **Fixed** (Revised commit:
807f523b40089ab4aa55cd98398f7eabd963e819)

7. EIP Standard Violation

Hashing structured data is non-trivial, and errors result in the loss of the security properties of the system.

Chain ID and the contract address are not used as part of the signature. It may result in double-spending if the contract is deployed on multiple networks.

Path: ./contracts/token/IncentiveDistributor.sol:
_checkClaim()

Recommendation: Use the EIP-712 standard for hashing and signing of typed structured data.

Status: Fixed (Revised commit:
807f523b40089ab4aa55cd98398f7eabd963e819)

8. Data inconsistency

When the admin alters the auction mode of a trade pair from the ExchangeSub contract, the auction mode of the related base token is automatically updated. However, if the admin does it from the TradePairs contract base the token's auction mode will not be updated.

This may lead to conflicts when the changes are done from the TradePairs contract.

Path: ./contracts/ExchangeSub.sol: setAuctionMode()

./contracts/TradePairs.sol: setAuctionMode()

Recommendation: Do not allow updating the auction mode of the base token from two different implementations/contracts.

Status: Fixed (Revised commit:
91b2b26ffe8cdc9b5411836621465db6d4299ed0)

■ ■ Medium

1. Unfinalized Code

The implementation contains a test oracle address on line 36 and a comment on line 34 that specifies that the address is going to be updated later.

This makes the code look unfinished.

Path: ./contracts/contracts/ExchangeMain.sol : function()

Recommendation: Finalise its implementation with the main oracle address.

Status: Fixed (Revised commit:
807f523b40089ab4aa55cd98398f7eabd963e819)

2. Missing Check Validation

When adding a new pair, the base display decimal is not checked against the base decimal.

In case of an event where the base display decimal is greater than the base decimal, the `decimalsOk` function will always revert, and adding an order will not be possible.

The same check statement is missing in the `addLimitOrder` function for quote decimals.

Path: `./contracts/TradePairs.sol: addTradePair(),
addLimitOrder()`

Recommendation: In the `addTradePair` and `addLimitOrder` functions, put a `require` statement that checks the `display decimals` against the `base/quote decimals`.

Status: Fixed

3. Data Inconsistency

Token details with the same symbol are recorded twice in two different contracts; `Portfolio` and `PortfolioBridge`. In the `PortfolioBridge` contract, different token information from the one in the `Portfolio` contract can be saved.

Path: `./contracts/PortfolioBridge.sol: addToken()`

Recommendation:

Status: Fixed (Revised commit:
`807f523b40089ab4aa55cd98398f7eabd963e819`)

4. Unused Enum Variable

The `BridgeProvider` type `CELER` is not validated anywhere in the project, and there is no implementation for it.

Path: `./contracts/PortfolioBridge.sol`

Recommendation: Consider `CELER` status or remove it from the project.

Status: Mitigated (Revised commit:
`807f523b40089ab4aa55cd98398f7eabd963e819`) (The Customer did not remove it on purpose to run their test cases to make sure that a message sent to a disabled bridge fails as expected.)

5. Code Duplication

Two different functions are detected for the same operation, setting the `LZ trusted remote address`. Moreover, one records the path without encoding while the other one is encoding.

Path: `./contracts/bridgeApps/LzApp.sol: setLZTrustedRemote,
setLZTrustedRemoteAddress`

Recommendation: Remove one of the functions.

Status: Fixed (Revised commit:
`807f523b40089ab4aa55cd98398f7eabd963e819`)

6. Redundant Function Implementation

The applied abstraction strategy for inheritance in the `Portfolio` contracts includes unnecessary interface components.

This can lead to users calling unimplemented functions on a contract, and result in a loss of funds or data corruption.

Path: ./contracts/PortfolioSub.sol : addIERC20,
getToken, depositToken, depositTokenFromContract

Recommendation: Improve the Portfolio abstraction or implement reverts on the empty functions.

Status: Fixed (Revised commit:
807f523b40089ab4aa55cd98398f7eabd963e819)

7. Best Practice Violation

The implementation of the OrderBooks mechanism is unusual. For each pair e.g. AVAX/USDT there can be a few combinations of order books: AVAX/USDT-BUYBOOK, AVAX/USDT-SELLBOOK, USDT/AVAX-BUYBOOK and USDT/AVAX-SELLBOOK.

This introduces unnecessary complexity into the order fulfilment process.

Path: ./contracts/TradePairs.sol: addTradePair()

Recommendation: Make the system match 1-to-1 with the way TradePairs that are set up.

Status: Fixed (Revised commit:
89d40a8aa3072dd9f21a13d41b6743a6fceed9dc)

■ Low

1. Typos in the Code

On line 55, the quoteSymbol parameter is misspelt.

Path: ./contracts/interfaces/ITradePairs.sol

Recommendation: Fix the syntax issue.

Status: Fixed (Revised commit:
807f523b40089ab4aa55cd98398f7eabd963e819)

2. Redundant Require Statement

Trusted contracts are already checked in the `depositToken` function. Therefore line 164 is redundant in the `depositTokenFromContract` contract.

Redundant code decreases code readability and causes higher consumption of Gas.

Path: ./contracts/PortfolioMain.sol: depositTokenFromContract()

Recommendation: Remove the redundant require statement.

Status: Mitigated (Revised commit:
807f523b40089ab4aa55cd98398f7eabd963e819) (The issue is mitigated due to the Customer's design preference)

3. Redundant Comparison

To revert the function in an unintended scenario, use `revert()` instead of `require(1 == 0)`.

Path: `./contracts/PortfolioBridge.sol: sendXChainMessageInternal`

Recommendation: Use the revert function instead of the require statement.

Status: Fixed (Revised commit:
807f523b40089ab4aa55cd98398f7eabd963e819)

4. Outdated Solidity Version

Using an outdated compiler version can be problematic, especially if publicly disclosed bugs and issues affect the current compiler version.

Paths: `./contracts/interfaces/layerZero/ILayerZeroEndpoint.sol,`
`./contracts/interfaces/layerZero/ILayerZeroReceiver.sol,`
`./contracts/interfaces/layerZero/ILayerZeroUserApplicationConfig.sol,`

Recommendation: Use a modern compiler version.

Status: Fixed (Revised commit:
807f523b40089ab4aa55cd98398f7eabd963e819)

5. Floating Pragma

Locking the pragma helps ensure that contracts do not accidentally get deployed using, for example, an outdated compiler version that might introduce bugs that affect the contract system negatively.

Paths: `./contracts/interfaces/layerZero/ILayerZeroEndpoint.sol,`
`./contracts/interfaces/layerZero/ILayerZeroReceiver.sol,`
`./contracts/interfaces/layerZero/ILayerZeroUserApplicationConfig.sol,`

Recommendation: Consider locking the pragma version whenever possible and avoid using a floating pragma in the final deployment.

Status: Fixed (Revised commit:
807f523b40089ab4aa55cd98398f7eabd963e819)

6. Unused Variables

A `PBRIDGE_ROLE` constant is declared but never used.

Redundant declarations decrease code readability and consume unnecessary Gas.

Path: `./contracts/Portfolio.sol`

Recommendation: Remove the redundant role declaration.

Status: Fixed (Revised commit:
807f523b40089ab4aa55cd98398f7eabd963e819)

7. Unchecked Return Value

The software does not check the return value of methods or functions, which can prevent it from detecting unexpected states and conditions.

An unexpected return value could place the system in a state that could lead to a crash or other unintended behaviors.

Paths: ./contracts/OrderBooks.sol : lines 467 and 440,
/contracts/Portfolio.sol : lines 416 and 434,
/contracts/PortfolioBridge.sol : lines 237 and 278,
/contracts/TradePairs.sol : lines 360, 372 and 128

Recommendation: Ensure that all possible return values from the function are taken into account.

Status: Mitigated (Revised commit: 807f523b40089ab4aa55cd98398f7eabd963e819) (The issue is mitigated based on the Customer's design preferences.)

8. Missing Zero Address Validation

Address parameters are being used without checking against the possibility of 0x0.

This can lead to unwanted external calls to 0x0.

Paths: ./contracts/GasStation.sol : requestGas(),
/contracts/IncentiveDistributor.sol : initialize(),
/contracts/PortfolioMain.sol : processXFerPayload()

Recommendation: Implement zero address checks.

Status: Fixed (Revised commit: 807f523b40089ab4aa55cd98398f7eabd963e819)

9. Redundant comparison

On line 384, checking the `_from.balance` twice is redundant. When the `"_from.balance >= gasStation.gasAmount() * 2 + msg.value"` condition is matched, `"_from.balance > msg.value"` will be matched already.

Paths: ./contracts/PortfolioSub.sol: depositNative()

Recommendation: Remove the first comparison of the require statement.

Status: Fixed (Revised commit: 89d40a8aa3072dd9f21a13d41b6743a6fceed9dc)

10. Contradiction - NatSpec Discrepancy

Parameter code is not explained in the OrderStatusChange event and some NatSpec format is missing in the TradePairs contract.

Paths: ./contracts/TradePairs.sol

Recommendation: Include all parameters in NatSpec format.

Status: Fixed (Revised commit: 1ec4b732b06dd2a25fe666cfde5b619af5b6f20b)

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11. Invalid Calculations in Events

In the `IncentiveDistributor.sol` contract's `claim()` function, the given `_tokenIds` parameter is decreased in the for loop and then its last value is emitted with the `Claimed` event.

This will result in the emitted value to be always equal to 0.

Paths: `./contracts/token/IncentiveDistributor.sol: claim()`

Recommendation: Store the first value of `_tokenIds` and use that in the event.

Status: Fixed (Revised commit:
ab85a832e0a3bda354a8b22b4040553424344a40)

12. Invalid Comparison

In the `PortfolioSub.sol` contract's `safeDecreaseTotal()` function there is a `require` statement that compares the amount of tokens to the fee charged for the transaction. If these are equal, the actual amount of tokens received will be 0.

This may result in unexpected behaviour.

Paths: `./contracts/PortfolioSub.sol: safeDecreaseTotal()`

Recommendation: Ensure that the `_amount` variable is larger than the `_feeCharged` variable.

Status: Fixed (Revised commit:
ab85a832e0a3bda354a8b22b4040553424344a40)

Disclaimers

Hacken Disclaimer

The smart contracts given for audit have been analyzed based on the best industry practices at the time of this report, with cybersecurity vulnerabilities and issues in smart contract source code, the details of which are disclosed in this report (Source Code); the Source Code compilation, deployment, and functionality (performing the intended functions).

The report contains no statements or warranties on the identification of all vulnerabilities and security of the code. The report covers the code submitted to and reviewed, so it may not be relevant after any modifications. Do not consider this report as a final and sufficient assessment regarding the utility and safety of the code, bug-free status, or any other contract statements.

While we have done our best in conducting the analysis and producing this report, it is important to note that you should not rely on this report only – we recommend proceeding with several independent audits and a public bug bounty program to ensure the security of smart contracts.

English is the original language of the report. The Consultant is not responsible for the correctness of the translated versions.

Technical Disclaimer

Smart contracts are deployed and executed on a blockchain platform. The platform, its programming language, and other software related to the smart contract can have vulnerabilities that can lead to hacks. Thus, Consultant cannot guarantee the explicit security of the audited smart contracts.