



Unlimited Size Contracts

Solidity Contracts Beyond 24KB

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Install

<https://github.com/ylv-io/devcon-bogota-workshop-2022>

```
curl -L https://foundry.paradigm.xyz | bash
```

```
foundryup
```

```
forge build
```



CONTRACT SIZE LIMIT 24KB



EVERY SOLIDITY DEV

imgflip.com

Solutions

- Reduce bytecode size
- External libs
- Static precompiled router
- Dynamic router

```
contract Counter is ICounter {
    uint256 public val;

    function set(uint256 newVal) public {
        val = newVal;
    }

    function get()
        external
        view
        returns (uint)
    {
        return val;
    }

    function const() external pure returns (uint256) {
        return 18;
    }
}
```

Counter Contract

- Baseline contract
- Has one SSTORE in the set method
- Has one SLOAD in the get method
- Allows easily to calculate gas overhead
- Has a pure function


```
library Storage {  
    function set(Data storage self, uint value)  
        public  
    {  
        self.counter = value;  
    }  
  
    function get(Data storage self)  
        public  
        view  
        returns (uint)  
    {  
        return self.counter;  
    }  
}
```

```
contract ExternalLibrary is ICounter {  
    Data private data;  
  
    function set(uint value) public {  
        Storage.set(data, value);  
    }  
  
    function get() public view returns (uint) {  
        return Storage.get(data);  
    }  
}
```

External Libs

Pros

- Security guarantees by Solidity
- Easy to add one more lib
- Somewhat gas efficient

Cons

- Have to put entire storage in one struct (or many)
- Have to use dot notation, e.g., `data.field`
- Not truly infinite
- Generates external functions
- Can't be used with upgrades

```
// Lookup table: Function selector => implementation contract
bytes4 sig4 = msg.sig;
address implementation;

assembly {
    let sig32 := shr(224, sig4)

    function findImplementation(sig) -> result {
        switch sig
        case 0x60fe47b1 { result := _COUNTER_MODULE } // _COUN
        case 0x6d4ce63c { result := _COUNTER_MODULE } // _COUN
        leave
    }

    implementation := findImplementation(sig32)
}
```

```
contract CounterStorage {
    function _store() internal pure returns (Data storage store) {
        bytes32 slot = bytes32(uint(keccak256("ylv.counter")) - 1);
        assembly {
            store.slot := slot
        }
    }
}
```

Static Precompiled Router

Pros

- Gas efficient 🤖🤖🤖
- Almost infinite
- No external functions

Cons

- Initialize methods instead of constructors
- Complicated cross module calls
- Have to use explicit storage slots and structs
- Development and maintenance overhead

```
function _forward() internal {
    bytes4 sig4 = msg.sig;
    VTableStore storage vtable = _store();

    address implementation = vtable.modules[msg.sig];

    if (implementation == address(0)) {
        revert UnknownSelector(sig4);
    }
}
```

```
function updateModules(ModuleDefinition[] calldata modules) public {
    VTableStore storage vtable = _store();

    for (uint256 i = 0; i < modules.length; ++i) {
        ModuleDefinition memory module = modules[i];
        for (uint256 j = 0; j < module.selectors.length; ++j) {
            vtable.modules[module.selectors[j]] = module.implementation;
        }
    }
}
```

Dynamic Router

Pros

- Truly infinite
- Can be updated at anytime
- No external functions

Cons

- Gas expensive
- Have to manage access
- Have to use explicit storage slots and structs

Checkout EIP-2535 (<https://eips.ethereum.org/EIPS/eip-2535>) by Nick Mudge (@mudgen)

Gas Report

Contract	const	get	set	quote
Base Contract	147	2303	22312	71831
External Library	3172/ 3025/2058%	5370/ 3067/133%	25414/ 3102/14%	196k/ 124796/173%
Static Router	3085/ 2938/1999%	5331/ 3028/131%	25313/ 3001/13%	80452/ 8621/12%
Dynamic Router	5213/ 5066/3446%	7481/ 5178/224%	27485/ 5173/23%	82591/ 10760/14%

- Gas overhead is significant for single SLOAD functions (which are common)
- The bigger function baseline gas cost the lesser impact gas overhead has
- External libraries are terrible for returning big amounts of data

Loaded Router

Contract	const	get	set
Static Router	3085	5331	25313
Loaded Static Router	147/2938/95%	2415/2916/54%	22419/2894/11%
Dynamic Router	5213	7481	27485
Loaded Dynamic Router	147/5066/97%	2415/5066/68%	22419/5066/18%

- Deploy low gas functions on router
- Deploy hot functions on router
- Pure functions have the biggest impact

Examples

ERC20Detailed

Optional functions from the ERC20 standard.

FUNCTIONS

`constructor(name, symbol, decimals)`

`name()`

`symbol()`

`decimals()`

`totalSupply()`

`balanceOf(account)`

`transfer(recipient, amount)`

`allowance(owner, spender)`

`approve(spender, amount)`

`transferFrom(sender, recipient, amount)`

IERC721Full

See <https://eips.ethereum.org/EIPS/eip-721>

FUNCTIONS

`name()`

`symbol()`

`tokenURI(tokenId)`

`totalSupply()`

`tokenOfOwnerByIndex(owner, index)`

`tokenByIndex(index)`

`balanceOf(owner)`

`ownerOf(tokenId)`

`safeTransferFrom(from, to, tokenId)`

`transferFrom(from, to, tokenId)`

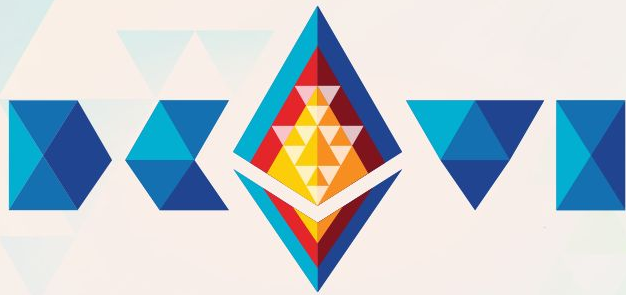
`approve(to, tokenId)`

`getApproved(tokenId)`

`setApprovalForAll(operator, _approved)`

`isApprovedForAll(owner, operator)`

`safeTransferFrom(from, to, tokenId, data)`



Thank you!

<https://github.com/ylv-io/devcon-bogota-workshop-2022>

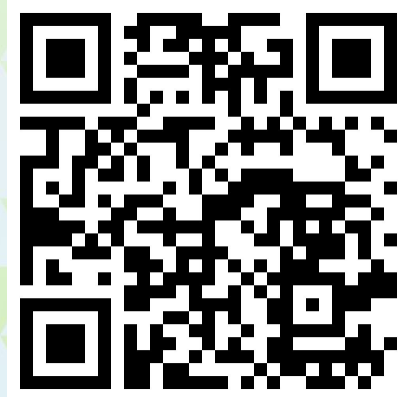
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The background is a complex geometric pattern composed of numerous triangles of various sizes and colors, including shades of orange, yellow, and light blue. These triangles are arranged in a way that creates a sense of depth and movement. Overlaid on this pattern are several thick, diagonal lines in muted colors like light blue, green, and yellow, which further enhance the abstract design.

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Event 1



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