

# Aggregation

Unter Aggregation wird bei SusScope2 die Zusammenfassung von mehreren Belegquellen für Treibhausgasemissionen zu einer Identität (Konto). Belegquellen können einzelne **GHG-Wallets** sein, wobei jede Aggregation für sich eine Identität ist. Dies hat zur Folge, dass die Emissionen aktiv mit einem **Transfer** von der Quelle an die Aggregation übertragen werden müssen.

Aggregationen finden ausschließlich in der Distributed Ledger Technologie statt, weshalb benötigte Metadaten auf einem anderen Weg übertragen werden müssen.

## Solidity Smart-Contract - Aggregation

```
pragma solidity ^0.8.6;

import "@openzeppelin/contracts/access/Ownable.sol";
import "./GHGNFT.sol";
import "./GHGERC20.sol";
import "./GHGTOKEN.sol";

contract GHGAggregation is Ownable {

    GHGToken ghgToken;
    GHGERC20 ghgSavings;
    GHGERC20 ghgEmissions;
    GHGNFT ghgCertificates;

    uint256 public savings=0;
    uint256 public emissions=0;
    uint256 public cntNFTs=0;
    uint256 public cntAggregations=0;

    mapping (uint256 => uint256) public idToNft;
    mapping (uint256 => address) public adToNft;

    mapping (address => uint256) public approvedContributors;
```

```

constructor(GHGTOKEN _ghgToken) {
    ghgToken = _ghgToken;
    ghgSavings = _ghgToken.ghgSavings();
    ghgEmissions = _ghgToken.ghgEmissions();
    ghgCertificates = _ghgToken.ghgCertificates();
}

function approveContributor(address _contributor) public onlyOwner {
    approvedContributors[_contributor] = 1;
}

function declineContributor(address _contributor) public onlyOwner {
    approvedContributors[_contributor] = 0;
}

function addNFT(uint256 _tokenId) public {
    if ((msg.sender != owner()) && (approvedContributors[msg.sender] == 0)) {
        revert();
    }
    if(ghgCertificates.ownerOf(_tokenId) == address(this)) {
        for(uint256 i=0;i<cntNFTs;i++) {
            if(idToNft[i] == _tokenId) revert();
        }
        idToNft[cntNFTs] = _tokenId;
        cntNFTs++;

        address hash = nftTokenHolder(_tokenId);
        savings += ghgSavings.balanceOf(hash);
        emissions += ghgEmissions.balanceOf(hash);
    } else {
        revert();
    }
}

function addAggregation(GHGAggregation _aggregation) onlyOwner public {
    if(_aggregation.owner() == address(this)) {
        for(uint256 i=0;i<cntAggregations;i++) {
            if(adToNft[i] == address(_aggregation)) revert();
        }
    }
}

```

```

        adToNft[cntAggregations] = address(_aggregation);
        cntAggregations++;
        savings += _aggregation.savings();
        emissions += _aggregation.emissions();
    } else {
        revert();
    }
}

```

```

function transferAggregation(address to, GHGAggregation _aggregation) onlyOwner public
{
    if(_aggregation.owner() == address(this)) {
        bool found=false;
        for(uint256 i=0;i<cntAggregations;i++) {
            if(adToNft[i] == address(_aggregation)) {
                adToNft[i]=address(0);
                found=true;
            }
        }
        if(found) {
            savings -= _aggregation.savings();
            emissions -= _aggregation.emissions();
            _aggregation.transferOwnership(to);
        } else {
            revert();
        }
    } else {
        revert();
    }
}

```

```

function transferNft(address to,uint256 _tokenId) onlyOwner public {
    if(ghgCertificates.ownerOf(_tokenId) == address(this)) {
        bool found=false;
        for(uint256 i=0;i<cntNFTs;i++) {
            if(idToNft[i] == _tokenId) {
                idToNft[i]=0;
                found=true;
            }
        }
    }
}

```

```

    }
    if(found) {
        address hash = nftTokenHolder(_tokenId);
        savings -= ghgSavings.balanceOf(hash);
        emissions -= ghgEmissions.balanceOf(hash);
        ghgCertificates.transferFrom(address(this), to, _tokenId);
    } else {
        revert();
    }
} else {
    revert();
}
}

function nftTokenHolder(uint256 _tokenId) public view returns (address) {
    string memory hash = ghgCertificates.tokenURI(_tokenId);
    uint endIndex = 99;
    uint startIndex = 57;

    bytes memory strBytes = bytes(hash);
    bytes memory result = new bytes(endIndex - startIndex);

    for(uint j = startIndex; j < endIndex; j++) {
        result[j - startIndex] = strBytes[j];
    }
    address did = toAddress(string(result));
    return did;
}

function fromHexChar(uint8 c) public pure returns (uint8) {
    if (bytes1(c) >= bytes1('0') && bytes1(c) <= bytes1('9')) {
        return c - uint8(bytes1('0'));
    }
    if (bytes1(c) >= bytes1('a') && bytes1(c) <= bytes1('f')) {
        return 10 + c - uint8(bytes1('a'));
    }
    if (bytes1(c) >= bytes1('A') && bytes1(c) <= bytes1('F')) {
        return 10 + c - uint8(bytes1('A'));
    }
}

```

```

    return 0;
}

function hexStringToAddress(string memory s) public pure returns (bytes memory) {
    bytes memory ss = bytes(s);
    require(ss.length%2 == 0); // length must be even
    bytes memory r = new bytes(ss.length/2);
    for (uint i=0; i<ss.length/2; ++i) {
        r[i] = bytes1(fromHexChar(uint8(ss[2*i])) * 16 +
                      fromHexChar(uint8(ss[2*i+1])));
    }

    return r;
}

function toAddress(string memory s) public pure returns (address) {
    bytes memory _bytes = hexStringToAddress(s);
    require(_bytes.length >= 1 + 20, "toAddress_outOfBounds");
    address tempAddress;

    assembly {
        tempAddress := div(mload(add(add(_bytes, 0x20), 1)),
0x10000000000000000000000000000000)
    }

    return tempAddress;
}
}

```

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