Benchmarking multiple vector theories

This notebook compares the following vector theories (sources in ./boogie-backend/prelude):

- BoogieArray: this is currently the default vector theory used in the Move Prover. It is based on Boogie Arrays (in contrast to native SMT arrays) and does not support extensional equality.
- SmtArray: this is a vector theory using SMT native arrays, without support for extensional equality.
- SmtArrayExt: this is a vector theory using SMT native arrays, with added axioms to ensure extensional equality.

Preparation

Load the prover-lab crate. This may take *long* (minutes) the first time the Jupyter server is started because it compiles a lot Rust sources.

In [2]:
```
:sccache 1
:dep prover-lab = { path = "../.." }
```

Out[2]:
```
sccache: true
```

Make functions from the benchmark module available:

In [3]:
```
use prover_lab::benchmark::*;
```

Module Verification Time

Overall module verification times (excluding timeouts):

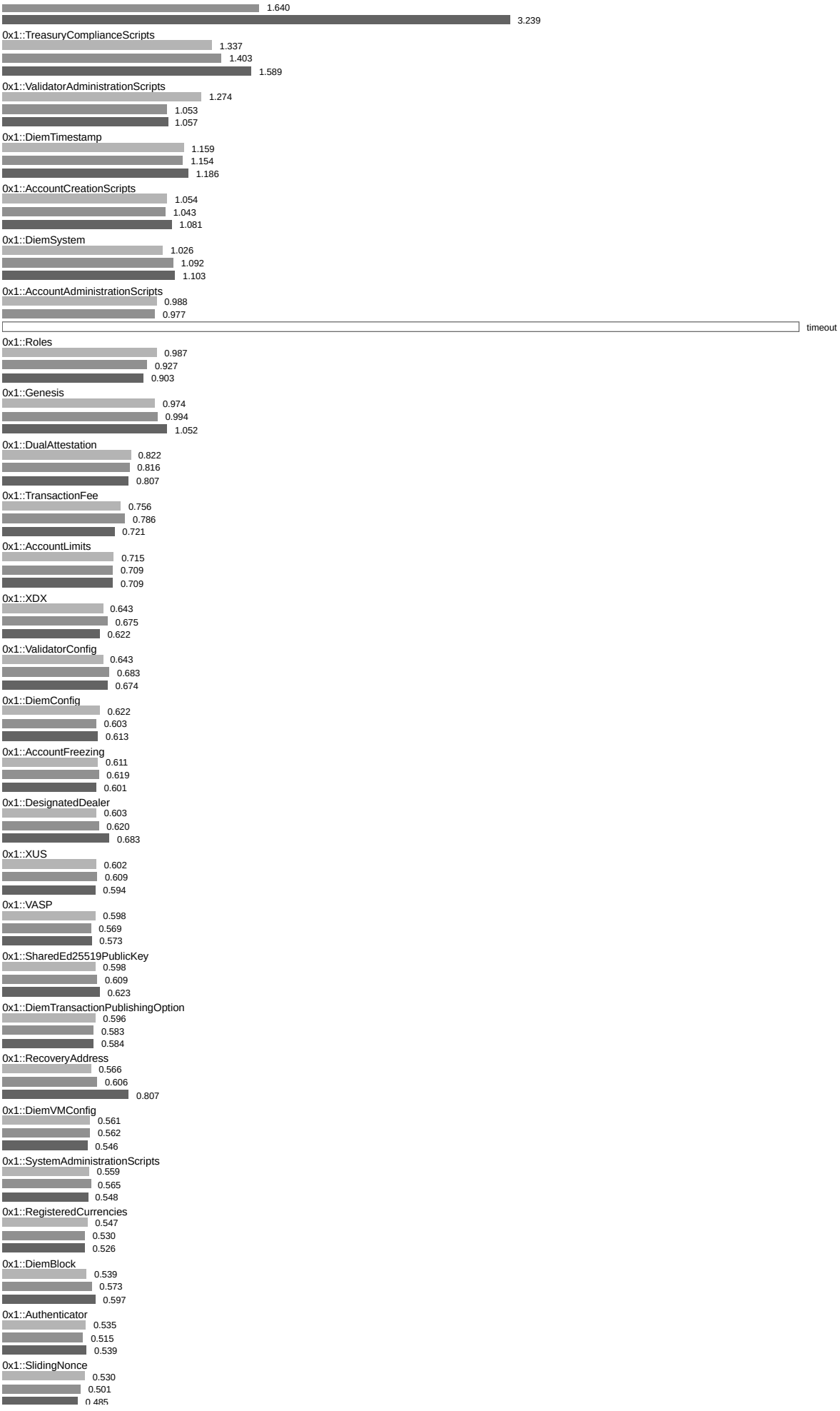
In [10]:
```
let mut boogie_array_mod_benchmark = read_benchmark("boogie_array.mod_data")?;
let mut smt_array_mod_benchmark = read_benchmark("smt_array.mod_data")?;
let mut smt_array_ext_mod_benchmark = read_benchmark("smt_array_ext.mod_data")?;
stats_benchmarks(&[&boogie_array_mod_benchmark, &smt_array_mod_benchmark, &smt_a
```

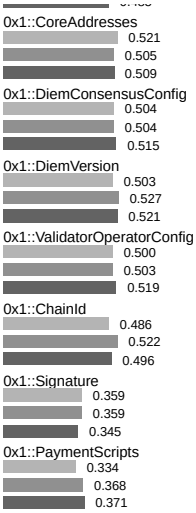
Out[10]:
```
boogie_array : 29.334s tot, 1.000 rel
smt_array    : 29.131s tot, 0.993 rel
smt_array_ext: 31.421s tot, 1.071 rel
```

Runtimes on module basis:

In [11]:
```
boogie_array_mod_benchmark.sort(); // Will also determine order of other samples
plot_benchmarks(&[&boogie_array_mod_benchmark, &smt_array_mod_benchmark, &smt_ar
```

Out[11]:


1.640
3.239
0x1::TreasuryComplianceScripts
1.337
1.403
1.589
0x1::ValidatorAdministrationScripts
1.274
1.053
1.057
0x1::DiemTimestamp
1.159
1.154
1.186
0x1::AccountCreationScripts
1.054
1.043
1.081
0x1::DiemSystem
1.026
1.092
1.103
0x1::AccountAdministrationScripts
0.988
0.977
timeout
0x1::Roles
0.987
0.927
0.903
0x1::Genesis
0.974
0.994
1.052
0x1::DualAttestation
0.822
0.816
0.807
0x1::TransactionFee
0.756
0.786
0.721
0x1::AccountLimits
0.715
0.709
0.709
0x1::XDX
0.643
0.675
0.622
0x1::ValidatorConfig
0.643
0.683
0.674
0x1::DiemConfig
0.622
0.603
0.613
0x1::AccountFreezing
0.611
0.619
0.601
0x1::DesignatedDealer
0.603
0.620
0.683
0x1::XUS
0.602
0.609
0.594
0x1::VASP
0.598
0.569
0.573
0x1::SharedEd25519PublicKey
0.598
0.609
0.623
0x1::DiemTransactionPublishingOption
0.596
0.583
0.584
0x1::RecoveryAddress
0.566
0.606
0.807
0x1::DiemVMConfig
0.561
0.562
0.546
0x1::SystemAdministrationScripts
0.559
0.565
0.548
0x1::RegisteredCurrencies
0.547
0.530
0.526
0x1::DiemBlock
0.539
0.573
0.597
0x1::Authenticator
0.535
0.515
0.539
0x1::SlidingNonce
0.530
0.501
0.485

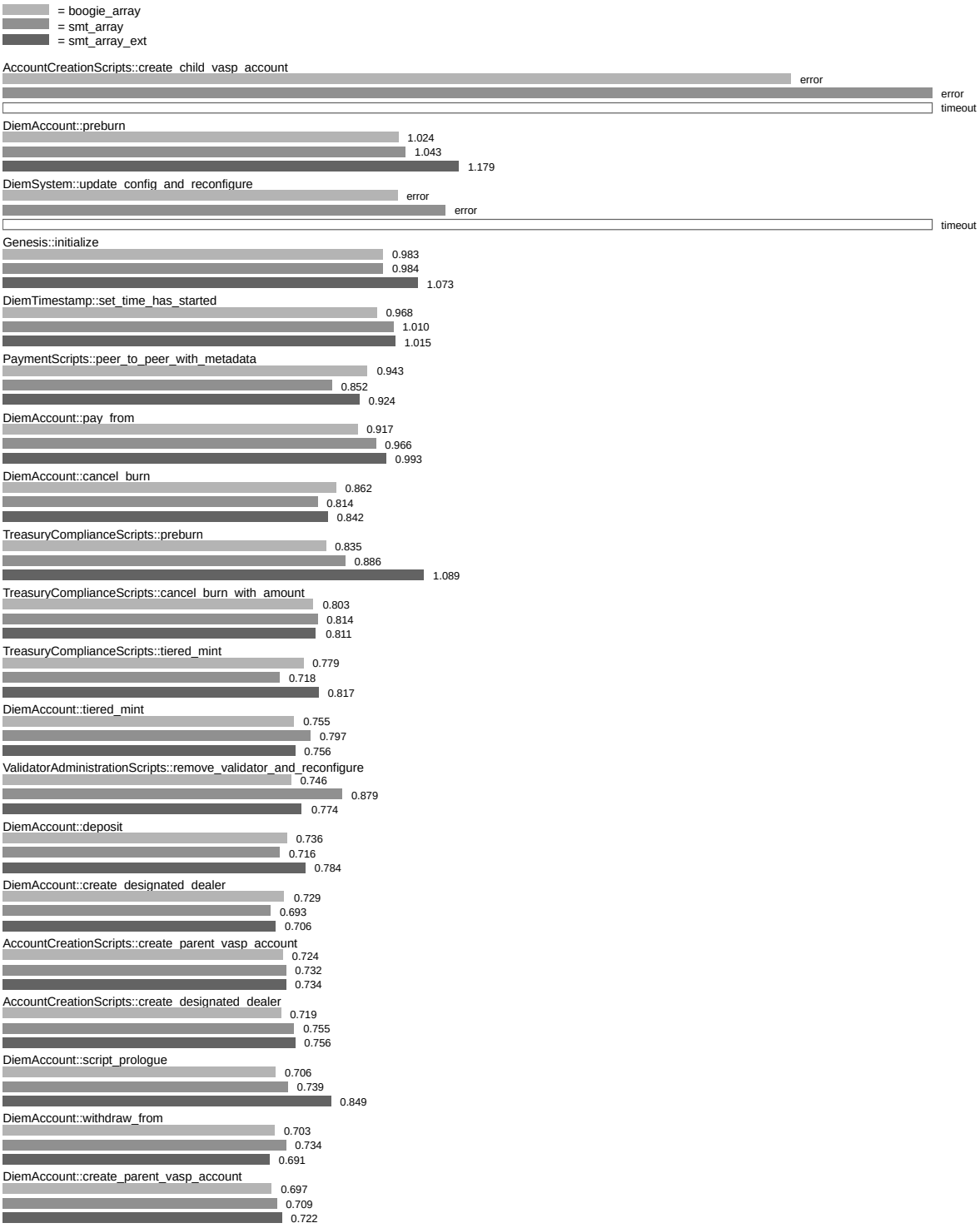


Top 20 by Function

In [12]:

```
let mut boogie_array_fun_benchmark = read_benchmark("boogie_array.fun_data")?;
let mut smt_array_fun_benchmark = read_benchmark("smt_array.fun_data")?;
let mut smt_array_ext_fun_benchmark = read_benchmark("smt_array_ext.fun_data")?;
boogie_array_fun_benchmark.sort();
boogie_array_fun_benchmark.take(20);
plot_benchmarks(&[&boogie_array_fun_benchmark, &smt_array_fun_benchmark, &smt_ar
```

Out[12]:


= boogie_array
= smt_array
= smt_array_ext
AccountCreationScripts::create_child_vasp_account
error
error
timeout
DiemAccount::preburn
1.024
1.043
1.179
DiemSystem::update_config_and_reconfigure
error
error
timeout
Genesis::initialize
0.983
0.984
1.073
DiemTimestamp::set_time_has_started
0.968
1.010
1.015
PaymentScripts::peer_to_peer_with_metadata
0.943
0.852
0.924
DiemAccount::pay_from
0.917
0.966
0.993
DiemAccount::cancel_burn
0.862
0.814
0.842
TreasuryComplianceScripts::preburn
0.835
0.886
1.089
TreasuryComplianceScripts::cancel_burn_with_amount
0.803
0.814
0.811
TreasuryComplianceScripts::tiered_mint
0.779
0.718
0.817
DiemAccount::tiered_mint
0.755
0.797
0.756
ValidatorAdministrationScripts::remove_validator_and_reconfigure
0.746
0.879
0.774
DiemAccount::deposit
0.736
0.716
0.784
DiemAccount::create_designated_dealer
0.729
0.693
0.706
AccountCreationScripts::create_parent_vasp_account
0.724
0.732
0.734
AccountCreationScripts::create_designated_dealer
0.719
0.755
0.756
DiemAccount::script_prologue
0.706
0.739
0.849
DiemAccount::withdraw_from
0.703
0.734
0.691
DiemAccount::create_parent_vasp_account
0.697
0.709
0.722

In [ ]: