Run time comparison between SGX protected and regular C process from Erlang NIF and C Node

Setup

Ubuntu 18.04, NUC7PJYH, DCAP 1.4 driver, SGX SDK 2.9.1

Erlang/OTP 20 [erts-9.2] [source] [64-bit] [smp:4:4] [ds:4:4:10] [async-threads:10] [kernel-poll:false]

Eshell V9.2

Pre-compiled Erlang from Ubuntu repository.

GCC / G++ 7.5.0-3

Execution

SGX versions are located directly in the root of the repo (erlang-c-node, erlang-nif), while the non-SGX versions are to be found in without-sgx/.

```
erl -sname e1 -setcookie "Very Secret Cookie"
c(enclave_communicator).
enclave_communicator:run_tests().
```

This function performs a simple (time) evaluation of calling C code in Erlang with C Node and NIF. In the background timer:tc is used in Erlang to measure time.

C NODE

Equivalent functionality without any SGX use

```
cd sgx-erlang-extension/without-sgx/erlang-c-node
make SGX_DEBUG=0

Calling increment, 30 times
Average time: 538.4 microseconds
Average time excluding first element: 76.24137931034483 microseconds
Raw data: [13941,88,85,84,84,84,89,84,85,84,85,91,71,71,
        71,71,70,72,70,70,70,70,70,70,72,70,70,70,70,70]

Calling return, 30 times
Average time: 76.16666666666667 microseconds
Average time excluding first element: 75.24137931034483 microseconds
Raw data: [103,93,91,91,91,96,91,71,70,70,70,70,70,71,71,
        70,70,72,71,71,70,70,71,71,71,70,76,71,71,71]
```

Hardware mode (release)

```
cd sgx-erlang-extension/erlang-c-node
make SGX_DEBUG=0

Calling increment, 30 times
Average time: 612.5 microseconds
Average time excluding first element: 104.48275862068965 microseconds
Raw data: [15345,157,149,145,142,144,143,165,143,118,110,109,110,
        146,143,117,103,67,66,67,66,70,66,66,69,68,70,70,71,70]

Calling return, 30 times
Average time: 67.5 microseconds
Average time excluding first element: 67.27586206896552 microseconds
Raw data: [74,67,82,71,71,66,69,65,66,70,71,66,65,65,
        65,65,69,66,65,65,65,65,71,66,66,65,65,69,65,65]
```

Hardware mode (debug)

```
cd sgx-erlang-extension/erlang-c-node
make SGX_DEBUG=1

Calling increment, 30 times
Average time: 578.8666666666667 microseconds
Average time excluding first element: 112.27586206896552 microseconds
Raw data: [14110,117,104,103,102,108,102,105,199,154,147,125,137,105,
        102,102,102,106,102,102,101,119,102,102,101,102,101,101,102,101]

Calling return, 30 times
Average time: 102.56666666666666 microseconds
Average time excluding first element: 102.20689655172414 microseconds
Raw data: [113,103,108,102,101,102,102,102,101,101,102,101,102,101,101,
        102,102,102,102,101,103,102,101,101,111,103,101,101,101,102]
```

Simulation mode (release)

```
cd sgx-erlang-extension/erlang-c-node
make SGX_MODE=SIM SGX_DEBUG=0

Calling increment, 30 times
Average time: 564.9333333333333 microseconds
Average time excluding first element: 111.13793103448276 microseconds
Raw data: [13725,129,124,124,122,123,122,122,123,123,109,109,101,133,130,
        109,101,104,101,101,101,101,101,101,101,101,101,102,103,101,101]

Calling return, 30 times
Average time: 101.83333333333333 microseconds
Average time excluding first element: 101.65517241379311 microseconds
Raw data: [107,103,102,101,101,101,101,103,101,101,101,101,101,101,101,
        101,115,101,101,100,101,102,101,101,101,101,101,101,101,101,101]
```

NIF

Equivalent functionality without any SGX use

```
cd sgx-erlang-extension/without-sgx/erlang-nif
make SGX_DEBUG=0

Calling increment, 30 times
Average time: 0.13333333333333333 microseconds
Average time excluding first element: 0.0 microseconds
Raw data: [4,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0]

Calling rtrn, 30 times
Average time: 0.06666666666666667 microseconds
Average time excluding first element: 0.0 microseconds
Raw data: [2,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0]
```

Hardware mode (release)

```
cd sgx-erlang-extension/erlang-nif
make SGX_DEBUG=0

Calling increment, 30 times
Average time: 31.5 microseconds
Average time excluding first element: 28.06896551724138 microseconds
Raw data: [131,29,28,28,28,28,28,26,27,28,28,28,28,28,28,28,28,28,28,28,28,30,
           28,28,28,30,28,28,28,28]

Calling rtrn, 30 times
Average time: 28.0 microseconds
Average time excluding first element: 27.862068965517242 microseconds
Raw data: [32,28,28,28,28,27,27,29,28,27,27,28,28,28,27,28,28,28,28,28,28,28,
           28,30,27,27,28,28,28,28]
```

Hardware mode (debug)

```
cd sgx-erlang-extension/erlang-nif
make SGX_DEBUG=1

Calling increment, 30 times
Average time: 30.866666666666667 microseconds
Average time excluding first element: 27.75862068965517 microseconds
Raw data: [121,29,28,28,28,27,28,28,27,28,27,27,28,28,28,27,28,28,27,28,28,29,
           28,27,27,28,28,28,28,27]

Calling rtrn, 30 times
Average time: 27.8 microseconds
Average time excluding first element: 27.655172413793103 microseconds
Raw data: [32,28,28,28,27,27,27,27,27,27,28,28,27,28,27,28,28,28,28,28,28,28,
           28,28,28,27,28,28,27,28]
```

Simulation mode (release)

```
cd sgx-erlang-extension/erlang-nif
make SGX_MODE=SIM SGX_DEBUG=0

Calling increment, 30 times
Average time: 22.433333333333334 microseconds
Average time excluding first element: 19.689655172413794 microseconds
Raw data: [102,18,17,17,17,17,16,16,17,17,17,17,16,16,100,18,17,16,17,17,16,
           19,17,16,17,16,18,16,16,17]

Calling rtrn, 30 times
Average time: 16.633333333333333 microseconds
Average time excluding first element: 16.482758620689655 microseconds
Raw data: [21,17,16,16,17,16,16,17,17,18,16,16,16,16,17,16,17,16,16,17,16,17,
           16,18,16,16,17,17,16,16]
```