PBErr

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Contents

Introduction

PBErr is a C library providing structures and functions to manage exception at runtime.

It uses no external library.

1 Interface

```
// ============ PBERR.H ================

#ifndef PBERR_H
#define PBERR_H

// ================= Include =================

#include <stdlib.h>
#include <stdio.h>
```

```
#include <stdbool.h>
#include <execinfo.h>

// ================= Define ==================

#define PBERR_MAXSTACKHEIGHT 10
#define PBERR_MSGLENGTHMAX 256

// ================= Data structure ==================

typedef enum PBErrType {
  PBErrTypeUnknown,
  PBErrTypeMallocFailed,
  PBErrTypeNullPointer,
  PBErrTypeInvalidArg,
  PBErrTypeUnitTestFailed,
  PBErrTypeOther,
  PBErrTypeInvalidData,
  PBErrTypeNb
} PBErrType;

typedef struct PBErr {
  // Error message
  char _msg[PBERR_MSGLENGTHMAX];
  // Error type
  PBErrType _type;
  // Strem for output
  FILE* _stream;
  // Fatal mode, if true exit when catch
  bool _fatal;
} PBErr;

// ================= Global variable ==================

extern PBErr thePBErr;
extern PBErr* PBMathErr;
extern PBErr* GSetErr;
extern PBErr* ELORankErr;
extern PBErr* ShapoidErr;
extern PBErr* BCurveErr;
extern PBErr* GenBrushErr;
extern PBErr* FracNoiseErr;
extern PBErr* GenAlgErr;

// ================ Functions declaration ====================

// Static constructor
PBErr PBErrCreateStatic(void);

// Reset thePBErr
void PBErrReset(PBErr* that);

// Hook for error handling
void PBErrCatch(PBErr* that);

// Print the PBErr 'that' on 'stream'
void PBErrPrintln(PBErr* that, FILE* stream);

// Secured malloc
#if defined(PBERRALL) || defined(PBERRSAFEMALLOC)
  void* PBErrMalloc(PBErr* that, size_t size);
#else
```

```
  #define PBErrMalloc(that, size) malloc(size)
#endif

// Hook for invalid polymorphisms
void PBErrInvalidPolymorphism(void*t, ...);

#endif
```

2 Code

2.1 pberr.c

```
// ============ PBERR.C ================

// ================= Include =================

#include "pberr.h"

// ================= Define ==================

PBErr thePBErr = {._msg[0] = '\0', ._type = PBErrTypeUnknown,
  ._stream = NULL, ._fatal = true};
PBErr* PBMathErr = &thePBErr;
PBErr* GSetErr = &thePBErr;
PBErr* ELORankErr = &thePBErr;
PBErr* ShapoidErr = &thePBErr;
PBErr* BCurveErr = &thePBErr;
PBErr* GenBrushErr = &thePBErr;
PBErr* FracNoiseErr = &thePBErr;
PBErr* GenAlgErr = &thePBErr;

char* PBErrTypeLbl[PBErrTypeNb] = {
  "unknown",
  "malloc failed",
  "null pointer",
  "invalid arguments",
  "unit test failed",
  "other"
};

// ================ Functions implementation ====================

// Static constructor
PBErr PBErrCreateStatic(void) {
  PBErr that = {._msg[0] = '\0', ._type = PBErrTypeUnknown,
    ._stream = NULL, ._fatal = true};
  return that;
}

// Reset thePBErr
void PBErrReset(PBErr* that) {
  if (that == NULL)
    return;
  that->_msg[0] = '\0';
  that->_type = PBErrTypeUnknown;
  that->_fatal = true;
}
```

```
// Hook for error handling
// Print the error type, the error message, the stack
// Exit if _fatal == true
// Reset the PBErr
void PBErrCatch(PBErr* that) {
  if (that == NULL)
    return;
  FILE* stream = (that->_stream ? that->_stream : stderr);
  fprintf(stream, "---- PBErrCatch ----\n");
  PBErrPrintln(that, stream);
  fprintf(stream, "Stack:\n");
  void* stack[PBERR_MAXSTACKHEIGHT] = {NULL};
  int stackHeight = backtrace(stack, PBERR_MAXSTACKHEIGHT);
  backtrace_symbols_fd(stack, stackHeight, fileno(stream));
  if (that->_fatal) {
    fprintf(stream, "Exiting\n");
    fprintf(stream, "--------------------\n");
    exit(that->_type);
  }
  fprintf(stream, "--------------------\n");
  PBErrReset(that);
}

// Print the PBErr 'that' on 'stream'
void PBErrPrintln(PBErr* that, FILE* stream) {
  // If the PBErr or stream is null
  if (that == NULL || stream == NULL)
    // Nothing to do
    return;
  if (that->_type > 0 && that->_type < PBErrTypeNb)
    fprintf(stream, "PBErrType: %s\n", PBErrTypeLbl[that->_type]);
  if (that->_msg != NULL)
    fprintf(stream, "PBErrMsg: %s\n", that->_msg);
  if (that->_fatal)
    fprintf(stream, "PBErrFatal: true\n");
  else
    fprintf(stream, "PBErrFatal: false\n");
}

// Secured malloc
#if defined(PBERRALL) || defined(PBERRSAFEMALLOC)
void* PBErrMalloc(PBErr* that, size_t size) {
  void* ret = malloc(size);
  if (ret == NULL) {
    that->_type = PBErrTypeMallocFailed;
    sprintf(that->_msg, "malloc of %d bytes failed\n", size);
    that->_fatal = true;
    PBErrCatch(that);
  }
  return ret;
}
#endif
```

3 Makefile

```
# Build mode
# 0: development (max safety, no optimisation)
# 1: release (min safety, optimisation)
# 2: fast and furious (no safety, optimisation)
```

```
BUILDMODE=0

include ./Makefile.inc

BUILDOPTIONS=$(BUILDPARAM) $(INCPATH)

#rules
all : main

main: main.o pberr.o Makefile
$(COMPILER) main.o pberr.o $(LINKOPTIONS) -o main

main.o : main.c pberr.h Makefile
$(COMPILER) $(BUILDOPTIONS) -c main.c

pberr.o : pberr.c pberr.h Makefile
$(COMPILER) $(BUILDOPTIONS) -c pberr.c

clean :
rm -rf *.o main

valgrind :
valgrind -v --track-origins=yes --leak-check=full --gen-suppressions=yes --show-leak-kinds=all ./main

unitTest :
main > unitTest.txt; diff unitTest.txt unitTestRef.txt
```

4 Unit tests

```
#include <stdlib.h>
#include <stdio.h>
#include <time.h>
#include <string.h>
#include "pberr.h"

void UnitTestCreateStatic() {
  printf("UnitTestCreateStatic\n");
  PBErr err = PBErrCreateStatic();
  PBErrPrintln(&err, stdout);
}

void UnitTestReset() {
  printf("UnitTestReset\n");
  PBErr err = PBErrCreateStatic();
  PBErr clone = err;
  memset(&err, 0, sizeof(PBErr));
  PBErrReset(&err);
    printf("Reset ");
  if (memcmp(&err, &clone, sizeof(PBErr)) == 0)
    printf("OK");
  else
    printf("NOK");
  printf("\n");
}

void UnitTestMalloc() {
  printf("UnitTestMalloc\n");
  char* arr = PBErrMalloc(&thePBErr, 2);
  printf("Malloc ");
```

```
  if (arr == NULL)
    printf("NOK");
  else
    printf("OK");
  printf("\n");
  arr[0] = 0;
  arr[1] = 1;
  free(arr);
}

void UnitTestCatch() {
  printf("UnitTestCatch\n");
  thePBErr._stream = stdout;
  thePBErr._type = PBErrTypeInvalidArg;
  sprintf(thePBErr._msg, "UnitTestCatch: invalid arg");
  thePBErr._fatal = false;
  PBErrCatch(&thePBErr);
  thePBErr._type = PBErrTypeNullPointer;
  sprintf(thePBErr._msg, "UnitTestCatch: null pointer");
  thePBErr._fatal = true;
  PBErrCatch(&thePBErr);
}

void UnitTestAll() {
  PBErrPrintln(&thePBErr, stdout);
  UnitTestCreateStatic();
  UnitTestReset();
  UnitTestMalloc();
  UnitTestCatch();
}

int main(void) {
  UnitTestAll();
  return 0;
}
```

5 Unit tests output

```
main(PBErrCatch+0x76)[0x8048f42]
main(UnitTestCatch+0x80)[0x8048d4e]
main(UnitTestAll+0x27)[0x8048ddc]
main(main+0x16)[0x8048df6]
/lib/i386-linux-gnu/libc.so.6(__libc_start_main+0xf7)[0xb7609637]
main[0x8048a51]
main(PBErrCatch+0x76)[0x8048f42]
main(UnitTestCatch+0xe3)[0x8048db1]
main(UnitTestAll+0x27)[0x8048ddc]
main(main+0x16)[0x8048df6]
/lib/i386-linux-gnu/libc.so.6(__libc_start_main+0xf7)[0xb7609637]
main[0x8048a51]
PBErrMsg:
PBErrFatal: true
UnitTestCreateStatic
PBErrMsg:
PBErrFatal: true
UnitTestReset
Reset OK
UnitTestMalloc
```

```
Malloc OK
UnitTestCatch
---- PBErrCatch ----
PBErrType: invalid arguments
PBErrMsg: UnitTestCatch: invalid arg
PBErrFatal: false
Stack:
--------------------
---- PBErrCatch ----
PBErrType: null pointer
PBErrMsg: UnitTestCatch: null pointer
PBErrFatal: true
Stack:
Exiting
--------------------
```