CString

1.0

Generated by Doxygen 1.13.2

Chapter 1

Class Index

1.1 Class List

Here are the classes, structs, unions and interfaces with brief descriptions:

Chapter 2

File Index

2.1 File List

Here is a list of all files with brief descriptions:

Chapter 3

Class Documentation

3.1 CString Struct Reference

Thread-safe dynamic string container.

`#include <cstr.h>`

Public Attributes

- char * data
  Character buffer.
- size_t length
  Current string length.
- size_t capacity
  Allocated buffer size.
- CRITICAL_SECTION cs
  Thread synchronization primitive.

3.1.1 Detailed Description

Thread-safe dynamic string container.

3.1.2 Member Data Documentation

3.1.2.1 capacity

`size_t CString::capacity`

Allocated buffer size.

3.1.2.2 cs

```
CRITICAL_SECTION CString::cs
```

Thread synchronization primitive.

3.1.2.3 data

```
char* CString::data
```

Character buffer.

3.1.2.4 length

```
size_t CString::length
```

Current string length.

The documentation for this struct was generated from the following file:

- include/cstr.h

Chapter 4

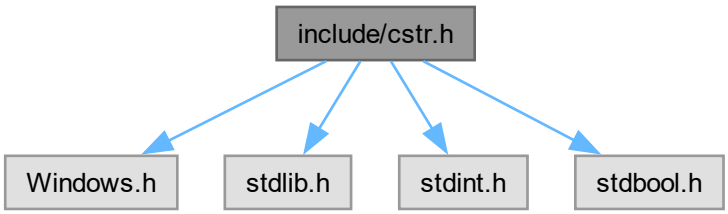
File Documentation

4.1 include/cstr.h File Reference

Thread-safe dynamic string implementation for C.

```
#include <Windows.h>
#include <stdlib.h>
#include <stdint.h>
#include <stdbool.h>
```

Include dependency graph for cstr.h:



Classes

- struct CString

  Thread-safe dynamic string container.

Macros

- #define CSTR_H

Functions

- char * cstr_strdup (_In_ const char *str)

  Duplicate null-terminated C string.
- wchar_t * cstr_wcsdup (_In_ const wchar_t *str)

  Duplicate null-terminated wide string.
- wchar_t * cstr_chars2wchars (_In_ const char *str, _In_ size_t cp)

  Convert multibyte string to wide character string.
- bool cstr_create (_Inout_ CString *obj)

  Initialize a new empty CString.
- bool cstr_create_from_cstr (_Inout_ CString *obj, _In_ CString *obj2)

  Create CString copy from another CString.
- bool cstr_create_from_chars (_Inout_ CString *obj, _In_ const char *data)

  Create CString from null-terminated C string.
- bool cstr_create_from_wchars (_Inout_ CString *obj, _In_ const wchar_t *data)

  Create CString from wide character string.
- bool cstr_create_from_buffer (_Inout_ CString *obj, _In_ uint8_t *buffer, _In_ size_t size)

  Create CString from binary buffer.
- bool cstr_destroy (_In_ CString *obj)

  Destroy CString and release resources.
- void cstr_lock (_In_ CString *obj)

  Acquire exclusive access.
- void cstr_unlock (_In_ CString *obj)

  Release exclusive access.
- boolean cstr_at (_In_ CString *obj, _In_ size_t index, _Inout_ char *chr)

  Get character at specific index.
- char cstr_get (_In_ CString *obj, _In_ size_t index)

  Direct character access (unsynchronized)
- char cstr_front (_In_ CString *obj)

  Get first character.
- char cstr_back (_In_ CString *obj)

  Get last character.
- char * cstr_data (_In_ CString *obj)

  Get raw character buffer.
- size_t cstr_length (_In_ CString *obj)

  Get current string length.
- size_t cstr_capacity (_In_ CString *obj)

  Get allocated buffer capacity.
- bool cstr_empty (_In_ CString *obj)

  Check if string is empty.
- bool cstr_resize (_In_ CString *obj, _In_ size_t size)

  Resize internal buffer.
- bool cstr_shrink_to_fit (_In_ CString *obj)

  Minimize buffer to fit current contents.
- bool cstr_clear (_In_ CString *obj)

  Clear string contents.
- bool cstr_push_back_char (_In_ CString *obj, _In_ char chr)

  Append single ASCII character.
- bool cstr_push_back_wchar (_In_ CString *obj, _In_ wchar_t chr)

  Append wide character.
- bool cstr_pop_back (_In_ CString *obj)

Remove last character.

- bool cstr_append_cstr (_In_ CString *obj, _In_ CString *obj2)

  Append CString contents.
- bool cstr_append_chars (_In_ CString *obj, _In_ const char *data)

  Append C string.
- bool cstr_append_wchars (_In_ CString *obj, _In_ const wchar_t *data)

  Append wide string.
- bool cstr_substring (_In_ CString *obj, _Inout_ CString *dest, _In_ size_t start, _In_ size_t length)

  Extract substring.
- bool cstr_erase (_In_ CString *obj, _In_ size_t index, _In_ size_t size)

  Remove characters.
- bool cstr_insert (_In_ CString *obj, _In_ size_t index, _In_ char chr)

  Insert character.
- bool cstr_swap (_In_ CString *obj, _In_ CString *obj2)

  Swap contents between two CStrings.
- size_t cstr_find_cstr (_In_ CString *obj, _In_ CString *obj2)

  Find substring (CString)
- size_t cstr_find_chars (_In_ CString *obj, _In_ const char *data)

  Find substring (C string)
- size_t cstr_find_wchars (_In_ CString *obj, _In_ const wchar_t *data)

  Find substring (wide string)
- bool cstr_to_upper (_In_ CString *obj)

  Convert to uppercase.
- bool cstr_to_lower (_In_ CString *obj)

  Convert to lowercase.
- bool cstr_trim (_In_ CString *obj)

  Trim whitespace from both ends.
- bool cstr_tokenize (_In_ CString *obj, _Inout_ CString *token, _In_ const char *delimiters, _Inout_ size_t *start_pos)

  Extract token using delimiters.
- bool cstr_tokenize_ex (_In_ CString *obj, _Inout_ CString *token, _In_ const char *delimiters, _In_ const char *zone_pairs, _In_ const char *escape_chars, _Inout_ size_t *start_pos)

  Advanced tokenization with zones/escaping.

Variables

- static const size_t invalid = (size_t)-1

4.1.1 Detailed Description

Thread-safe dynamic string implementation for C.

4.1.2 Macro Definition Documentation

4.1.2.1 CSTR_H

```
#define CSTR_H
```

4.1.3 Function Documentation

4.1.3.1 cstr_append_chars()

```
bool cstr_append_chars (
            _In_ CString * obj,
            _In_ const char * data)
```

Append C string.

Parameters

obj	Destination CString
data	Null-terminated source string

Returns

true on success

4.1.3.2 cstr_append_cstr()

```
bool cstr_append_cstr (
            _In_ CString * obj,
            _In_ CString * obj2)
```

Append CString contents.

Parameters

obj	Destination CString
obj2	Source CString

Returns

true on success

4.1.3.3 cstr_append_wchars()

```
bool cstr_append_wchars (
            _In_ CString * obj,
            _In_ const wchar_t * data)
```

Append wide string.

Parameters

obj	Destination CString
data	Null-terminated wide string

Returns

true on success

Note

Converts using system code page

4.1.3.4 cstr_at()

```
boolean cstr_at (
            _In_ CString * obj,
            _In_ size_t index,
            _Inout_ char * chr)
```

Get character at specific index.

Parameters

obj	CString object
index	Character position (0-based)
chr	Output character

Returns

true if index valid, false otherwise

Note

Thread-safe version with bounds checking

4.1.3.5 cstr_back()

```
char cstr_back (
            _In_ CString * obj)
```

Get last character.

Parameters

obj	CString object

Returns

Last character or 0 if empty

4.1.3.6 cstr_capacity()

```
size_t cstr_capacity (
            _In_ CString * obj)
```

Get allocated buffer capacity.

Parameters

obj	CString object

Returns

Capacity in bytes or CSTR_INVALID

4.1.3.7 cstr_chars2wchars()

```
wchar_t * cstr_chars2wchars (
            _In_ const char * str,
            _In_ size_t cp)
```

Convert multibyte string to wide character string.

Parameters

str	Null-terminated source multibyte string
cp	Character Page for convertion

Returns

New allocated wide string or NULL on failure

Warning

Caller must free result with free()

4.1.3.8 cstr_clear()

```
bool cstr_clear (
            _In_ CString * obj)
```

Clear string contents.

Parameters

obj	CString object

Returns

true on success

Note

Securely erases buffer and resets length

4.1.3.9 cstr_create()

```
bool cstr_create (
            _Inout_ CString * obj)
```

Initialize a new empty CString.

Parameters

obj	Pointer to CString object to initialize

Returns

true on success, false on allocation failure

Note

Creates empty string with capacity 1

4.1.3.10 cstr_create_from_buffer()

```
bool cstr_create_from_buffer (
            _Inout_ CString * obj,
            _In_ uint8_t * buffer,
            _In_ size_t size)
```

Create CString from binary buffer.

Parameters

obj	Destination CString
buffer	Source binary data
size	Number of bytes to copy

Returns

true on success, false on allocation failure

Note

Adds null-terminator after buffer contents

4.1.3.11 cstr_create_from_chars()

```
bool cstr_create_from_chars (
            _Inout_ CString * obj,
            _In_ const char * data)
```

Create CString from null-terminated C string.

Parameters

obj	Destination CString
data	Source C string

Returns

true on success, false on allocation failure

4.1.3.12 cstr_create_from_cstr()

```
bool cstr_create_from_cstr (
            _Inout_ CString * obj,
            _In_ CString * obj2)
```

Create CString copy from another CString.

Parameters

obj	Destination CString
obj2	Source CString

Returns

true on success, false on allocation failure

4.1.3.13 cstr_create_from_wchars()

```
bool cstr_create_from_wchars (
            _Inout_ CString * obj,
            _In_ const wchar_t * data)
```

Create CString from wide character string.

Parameters

obj	Destination CString
data	Source wide string

Returns

true on success, false on conversion/allocation failure

Note

Uses WideCharToMultiByte with ANSI code page

4.1.3.14 cstr_data()

```
char * cstr_data (
            _In_ CString * obj)
```

Get raw character buffer.

Parameters

obj	CString object

Returns

Pointer to internal buffer

Warning

Buffer valid until next modifying operation

4.1.3.15 cstr_destroy()

```
bool cstr_destroy (
            _In_ CString * obj)
```

Destroy CString and release resources.

Parameters

obj	CString to destroy

Returns

true on success, false for invalid object

Note

Securely erases memory before freeing

4.1.3.16 cstr_empty()

```
bool cstr_empty (
            _In_ CString * obj)
```

Check if string is empty.

Parameters

obj	CString object

Returns

true if empty, false otherwise

4.1.3.17 cstr_erase()

```
bool cstr_erase (
            _In_ CString * obj,
            _In_ size_t index,
            _In_ size_t size)
```

Remove characters.

Parameters

obj	CString object
index	Starting position
size	Number of characters to remove

Returns

true on success

4.1.3.18 cstr_find_chars()

```
size_t cstr_find_chars (
            _In_ CString * obj,
            _In_ const char * data)
```

Find substring (C string)

Parameters

obj	CString to search
data	Null-terminated substring

Returns

Starting index or CSTR_INVALID

4.1.3.19 cstr_find_cstr()

```
size_t cstr_find_cstr (
            _In_ CString * obj,
            _In_ CString * obj2)
```

Find substring (CString)

Parameters

obj	CString to search
obj2	Substring to find

Returns

Starting index or CSTR_INVALID

4.1.3.20 cstr_find_wchars()

```
size_t cstr_find_wchars (
            _In_ CString * obj,
            _In_ const wchar_t * data)
```

Find substring (wide string)

Parameters

obj	CString to search
data	Null-terminated wide substring

Returns

Starting index or CSTR_INVALID

Note

Converts using system code page

4.1.3.21 cstr_front()

```
char cstr_front (
            _In_ CString * obj)
```

Get first character.

Parameters

obj	CString object

Returns

First character or 0 if empty

4.1.3.22 cstr_get()

```
char cstr_get (
            _In_ CString * obj,
            _In_ size_t index)
```

Direct character access (unsynchronized)

Parameters

obj	CString object
index	Character position

Returns

Character or 0 for invalid index

Warning

Not thread-safe - use between lock/unlock calls

4.1.3.23 cstr_insert()

```
bool cstr_insert (
            _In_ CString * obj,
            _In_ size_t index,
            _In_ char chr)
```

Insert character.

Parameters

obj	CString object
index	Insertion position
chr	Character to insert

Returns

true on success

4.1.3.24 cstr_length()

```
size_t cstr_length (
            _In_ CString * obj)
```

Get current string length.

Parameters

obj	CString object

Returns

Length in bytes or CSTR_INVALID

4.1.3.25 cstr_lock()

```
void cstr_lock (
            _In_ CString * obj)
```

Acquire exclusive access.

Parameters

obj	CString object

4.1.3.26 cstr_pop_back()

```
bool cstr_pop_back (
            _In_ CString * obj)
```

Remove last character.

Parameters

obj	CString object

Returns

true if character removed, false if empty

4.1.3.27 cstr_push_back_char()

```
bool cstr_push_back_char (
            _In_ CString * obj,
            _In_ char chr)
```

Append single ASCII character.

Parameters

obj	CString object
chr	Character to append

Returns

true on success

4.1.3.28 cstr_push_back_wchar()

```
bool cstr_push_back_wchar (
            _In_ CString * obj,
            _In_ wchar_t chr)
```

Append wide character.

Parameters

obj	CString object
chr	Wide character to append

Returns

true on success

Note

Converts to multibyte using system code page

4.1.3.29 cstr_resize()

```
bool cstr_resize (
            _In_ CString * obj,
            _In_ size_t size)
```

Resize internal buffer.

Parameters

obj	CString object
size	New buffer size

Returns

true on success, false on allocation failure

Note

Does not modify string contents

4.1.3.30 cstr_shrink_to_fit()

```
bool cstr_shrink_to_fit (
            _In_ CString * obj)
```

Minimize buffer to fit current contents.

Parameters

obj	CString object

Returns

true on success, false on allocation failure

4.1.3.31 cstr_strdup()

```
char * cstr_strdup (
            _In_ const char * str)
```

Duplicate null-terminated C string.

Parameters

str	Source string to copy

Returns

New allocated copy on success, NULL on failure

Note

Safe replacement for non-standard strdup()

Warning

Caller must free result with free()

4.1.3.32 cstr_substring()

```
bool cstr_substring (
            _In_ CString * obj,
            _Inout_ CString * dest,
            _In_ size_t start,
            _In_ size_t length)
```

Extract substring.

Parameters

obj	Source CString
dest	Destination CString
start	Starting index
length	Number of characters to extract

Returns

true on success

Note

Automatically clamps to valid range

4.1.3.33 cstr_swap()

```
bool cstr_swap (
            _In_ CString * obj,
            _In_ CString * obj2)
```

Swap contents between two CStrings.

Parameters

obj	First CString
obj2	Second CString

Returns

true on success

4.1.3.34 cstr_to_lower()

```
bool cstr_to_lower (
            _In_ CString * obj)
```

Convert to lowercase.

Parameters

obj	CString object

Returns

true on success

4.1.3.35 cstr_to_upper()

```
bool cstr_to_upper (
            _In_ CString * obj)
```

Convert to uppercase.

Parameters

obj	CString object

Returns

true on success

4.1.3.36 cstr_tokenize()

```
bool cstr_tokenize (
            _In_ CString * obj,
            _Inout_ CString * token,
            _In_ const char * delimiters,
            _Inout_ size_t * start_pos)
```

Extract token using delimiters.

Parameters

obj	Source CString
token	Output token
delimiters	Separator characters
start_pos	Starting/ending position (updated)

Returns

true if token found

4.1.3.37 cstr_tokenize_ex()

```
bool cstr_tokenize_ex (
            _In_ CString * obj,
            _Inout_ CString * token,
            _In_ const char * delimiters,
            _In_ const char * zone_pairs,
            _In_ const char * escape_chars,
            _Inout_ size_t * start_pos)
```

Advanced tokenization with zones/escaping.

Parameters

obj	Source CString
token	Output token
delimiters	Separator characters
zone_pairs	Zone delimiter pairs (e.g., "\"\"")
escape_chars	Escape characters
start_pos	Starting/ending position (updated)

Returns

true if token found

```
size_t pos = 0;
CString str, token;
cstr_create_from_chars(&str, "Hello, \"my world\"!");
while (cstr_tokenize_ex(&str, &token, " ", "\"\"", "\\", &pos))
    printf("Token: %s\n", cstr_data(&token));
```

4.1.3.38 cstr_trim()

```
bool cstr_trim (
            _In_ CString * obj)
```

Trim whitespace from both ends.

Parameters

obj	CString object

Returns

true if modified, false otherwise

4.1.3.39 cstr_unlock()

```
void cstr_unlock (
            _In_ CString * obj)
```

Release exclusive access.

Parameters

obj	CString object

4.1.3.40 cstr_wcsdup()

```
wchar_t * cstr_wcsdup (
            _In_ const wchar_t * str)
```

Duplicate null-terminated wide string.

Parameters

str	Source wide string to copy

Returns

New allocated copy on success, NULL on failure

Note

Wide char version of cstr_strdup()

Warning

Caller must free result with free()

4.1.4 Variable Documentation

4.1.4.1 invalid

```
const size_t invalid = (size_t)-1  [static]
```

4.2 cstr.h

Go to the documentation of this file.

```
00001 #pragma once
00002
00007
00008 #ifndef CSTR_H
00009 #define CSTR_H
00010
00011 #include <Windows.h>
00012 #include <stdlib.h>
00013 #include <stdint.h>
00014 #include <stdbool.h>
00015
00016 #ifdef __cplusplus
00017 extern "C"
00018 {
00019 #endif
00020
00025     static const size_t invalid = (size_t)-1;
00026
00036     typedef struct
00037     {
00038         char* data;
00039         size_t length;
00040         size_t capacity;
00041         CRITICAL_SECTION cs;
00042     }CString;
00043
00051     char* cstr_strdup(_In_ const char* str)
00052     {
00053         size_t len = strlen(str) + 1;
00054         char* buf = (char*)malloc(len);
00055         if (buf)
00056             memcpy(buf, str, len);
00057         return buf;
00058     }
00059
00067     wchar_t* cstr_wcsdup(_In_ const wchar_t* str)
00068     {
00069         size_t len = (wcslen(str) + 1) * sizeof(wchar_t);
```

```
00070         wchar_t* buf = (wchar_t*)malloc(len);
00071         if (buf)
00072             memcpy(buf, str, len);
00073         return buf;
00074     }
00075
00083     wchar_t* cstr_chars2wchars(_In_ const char* str, _In_ size_t cp)
00084     {
00085         int wlen = MultiByteToWideChar(cp, MB_ERR_INVALID_CHARS, str, -1, NULL, 0);
00086         wchar_t* buf = (wchar_t*)malloc(wlen * sizeof(wchar_t));
00087         if (!buf)
00088             return NULL;
00089         if (!MultiByteToWideChar(cp, 0, str, -1, buf, wlen))
00090         {
00091             free(buf);
00092             return NULL;
00093         }
00094         return buf;
00095     }
00096
00103     bool cstr_create(_Inout_ CString* obj)
00104     {
00105         if (!obj)
00106             return false;
00107
00108         char* data = (char*)malloc(1);
00109         if (data == NULL)
00110             return false;
00111
00112         data[0] = '\0';
00113
00114         obj->data = data;
00115         obj->length = 0;
00116         obj->capacity = 1;
00117
00118         InitializeCriticalSection(&obj->cs);
00119
00120         return true;
00121     }
00122
00129     bool cstr_create_from_cstr(_Inout_ CString* obj, _In_ CString* obj2)
00130     {
00131         if (!obj || !obj2)
00132             return false;
00133
00134         obj->data = cstr_strdup(obj2->data);
00135         obj->length = obj2->length;
00136         obj->capacity = obj2->capacity;
00137
00138         InitializeCriticalSection(&obj->cs);
00139
00140         return true;
00141     }
00142
00149     bool cstr_create_from_chars(_Inout_ CString* obj, _In_ const char* data)
00150     {
00151         if (!obj || !data)
00152             return false;
00153
00154         obj->data = cstr_strdup(data);
00155         obj->length = strlen(data);
00156         obj->capacity = obj->length + 1;
00157
00158         InitializeCriticalSection(&obj->cs);
00159
00160         return true;
00161     }
00162
00170     bool cstr_create_from_wchars(_Inout_ CString* obj, _In_ const wchar_t* data)
00171     {
00172         if (!obj || !data)
00173             return false;
00174
00175         int len = WideCharToMultiByte(CP_ACP, 0, data, -1, NULL, 0, NULL, NULL);
00176         if (len == 0)
00177             return false;
00178
00179         char* mb_data = (char*)malloc(len);
00180         if (!mb_data)
00181             return false;
00182
00183         if (!WideCharToMultiByte(CP_ACP, 0, data, -1, mb_data, len, NULL, NULL))
00184         {
00185             free(mb_data);
00186             return false;
00187         }
00188
```

```
00189         obj->data = mb_data;
00190         obj->length = strlen(mb_data);
00191         obj->capacity = len;
00192 
00193         InitializeCriticalSection(&obj->cs);
00194 
00195         return true;
00196     }
00197 
00206     bool cstr_create_from_buffer(_Inout_ CString* obj, _In_ uint8_t* buffer, _In_ size_t size)
00207     {
00208         if (!obj || !buffer)
00209             return false;
00210 
00211         char* data = (char*)malloc(size + 1);
00212         if (data == NULL)
00213             return false;
00214 
00215         memcpy(data, (void*)buffer, size);
00216         data[size] = '\0';
00217 
00218         obj->data = data;
00219         obj->length = size;
00220         obj->capacity = size + 1;
00221 
00222         InitializeCriticalSection(&obj->cs);
00223 
00224         return true;
00225     }
00226 
00233     bool cstr_destroy(_In_ CString* obj)
00234     {
00235         if (!obj)
00236             return false;
00237 
00238         if (obj->data)
00239         {
00240             SecureZeroMemory(obj->data, obj->capacity);
00241             free(obj->data);
00242             obj->data = NULL;
00243         }
00244 
00245         DeleteCriticalSection(&obj->cs);
00246 
00247         obj->length = 0;
00248         obj->capacity = 0;
00249 
00250         return true;
00251     }
00252 
00257     void cstr_lock(_In_ CString* obj)
00258     {
00259         if (obj)
00260             EnterCriticalSection(&obj->cs);
00261     }
00262 
00267     void cstr_unlock(_In_ CString* obj)
00268     {
00269         if (obj)
00270             LeaveCriticalSection(&obj->cs);
00271     }
00272 
00281     boolean cstr_at(_In_ CString* obj, _In_ size_t index, _Inout_ char* chr)
00282     {
00283         if (!obj)
00284             return false;
00285 
00286         cstr_lock(obj);
00287 
00288         if (index >= obj->length)
00289         {
00290             cstr_unlock(obj);
00291             return false;
00292         }
00293 
00294         *chr = obj->data[index];
00295 
00296         cstr_unlock(obj);
00297 
00298         return true;
00299     }
00300 
00308     char cstr_get(_In_ CString* obj, _In_ size_t index)
00309     {
00310         if (!obj)
00311             return 0;
00312 
```

```
00313         cstr_lock(obj);
00314
00315         char out = obj->data[index];
00316
00317         cstr_unlock(obj);
00318
00319         return out;
00320     }
00321
00327     char cstr_front(_In_ CString* obj)
00328     {
00329         if (!obj)
00330             return 0;
00331
00332         cstr_lock(obj);
00333
00334         char out = cstr_get(obj, 0);
00335
00336         cstr_unlock(obj);
00337
00338         return out;
00339     }
00340
00346     char cstr_back(_In_ CString* obj)
00347     {
00348         if (!obj)
00349             return 0;
00350
00351         cstr_lock(obj);
00352
00353         char out = cstr_get(obj, obj->length - 1);
00354
00355         cstr_unlock(obj);
00356
00357         return out;
00358     }
00359
00366     char* cstr_data(_In_ CString* obj)
00367     {
00368         if (!obj)
00369             return 0;
00370
00371         cstr_lock(obj);
00372
00373         char* out = obj->data;
00374
00375         cstr_unlock(obj);
00376
00377         return out;
00378     }
00379
00385     size_t cstr_length(_In_ CString* obj)
00386     {
00387         if (!obj)
00388             return invalid;
00389
00390         cstr_lock(obj);
00391
00392         size_t out = obj->length;
00393
00394         cstr_unlock(obj);
00395
00396         return out;
00397     }
00398
00404     size_t cstr_capacity(_In_ CString* obj)
00405     {
00406         if (!obj)
00407             return invalid;
00408
00409         cstr_lock(obj);
00410
00411         size_t out = obj->capacity;
00412
00413         cstr_unlock(obj);
00414
00415         return out;
00416     }
00417
00423     bool cstr_empty(_In_ CString* obj)
00424     {
00425         if (!obj)
00426             return false;
00427
00428         cstr_lock(obj);
00429
00430         bool out = obj->data == NULL || obj->length == 0;
```

```
00431
00432         cstr_unlock(obj);
00433
00434         return out;
00435     }
00436
00444     bool cstr_resize(_In_ CString* obj, _In_ size_t size)
00445     {
00446         if (!obj)
00447             return false;
00448
00449         cstr_lock(obj);
00450
00451         char* new_data = (char*)realloc(obj->data, size);
00452         if (new_data == NULL)
00453         {
00454             cstr_unlock(obj);
00455             return false;
00456         }
00457
00458         obj->data = new_data;
00459         obj->capacity = size;
00460
00461         cstr_unlock(obj);
00462
00463         return true;
00464     }
00465
00471     bool cstr_shrink_to_fit(_In_ CString* obj)
00472     {
00473         if (!obj)
00474             return false;
00475
00476         cstr_lock(obj);
00477
00478         if (!cstr_resize(obj, obj->length + 1))
00479         {
00480             cstr_unlock(obj);
00481             return false;
00482         }
00483
00484         cstr_unlock(obj);
00485
00486         return true;
00487     }
00488
00495     bool cstr_clear(_In_ CString* obj)
00496     {
00497         if (!obj)
00498             return false;
00499
00500         cstr_lock(obj);
00501
00502         SecureZeroMemory(obj->data, obj->capacity);
00503         obj->length = 0;
00504
00505         cstr_unlock(obj);
00506
00507         return true;
00508     }
00509
00516     bool cstr_push_back_char(_In_ CString* obj, _In_ char chr)
00517     {
00518         if (!obj)
00519             return false;
00520
00521         cstr_lock(obj);
00522
00523         if (obj->length + 1 >= obj->capacity)
00524         {
00525             if (!cstr_resize(obj, obj->length + 2))
00526             {
00527                 cstr_unlock(obj);
00528                 return false;
00529             }
00530         }
00531
00532         obj->data[obj->length] = chr;
00533         obj->data[obj->length + 1] = '\0';
00534         obj->length++;
00535
00536         cstr_unlock(obj);
00537
00538         return true;
00539     }
00540
00548     bool cstr_push_back_wchar(_In_ CString* obj, _In_ wchar_t chr)
```

```
00549     {
00550         if (!obj)
00551             return false;
00552 
00553         cstr_lock(obj);
00554 
00555         wchar_t wstr[2] = { chr, L'\0' };
00556         int required_mb_len = WideCharToMultiByte(CP_ACP, 0, wstr, -1, NULL, 0, NULL, NULL);
00557         if (required_mb_len <= 0)
00558         {
00559             cstr_unlock(obj);
00560             return false;
00561         }
00562 
00563         char* mb_str = (char*)malloc(required_mb_len);
00564         if (!mb_str)
00565         {
00566             cstr_unlock(obj);
00567             return false;
00568         }
00569 
00570         if (WideCharToMultiByte(CP_ACP, 0, wstr, -1, mb_str, required_mb_len, NULL, NULL) == 0)
00571         {
00572             free(mb_str);
00573             cstr_unlock(obj);
00574             return false;
00575         }
00576 
00577         size_t data_len = required_mb_len - 1;
00578 
00579         size_t new_length = obj->length + data_len;
00580         size_t required_capacity = new_length + 1;
00581 
00582         if (required_capacity > obj->capacity)
00583         {
00584             size_t new_capacity = required_capacity;
00585             char* new_data = (char*)realloc(obj->data, new_capacity);
00586             if (!new_data)
00587             {
00588                 free(mb_str);
00589                 cstr_unlock(obj);
00590                 return false;
00591             }
00592             obj->data = new_data;
00593             obj->capacity = new_capacity;
00594         }
00595 
00596         memcpy(obj->data + obj->length, mb_str, data_len);
00597         obj->length = new_length;
00598         obj->data[new_length] = '\0';
00599 
00600         free(mb_str);
00601         cstr_unlock(obj);
00602 
00603         return true;
00604     }
00605 
00611     bool cstr_pop_back(_In_ CString* obj)
00612     {
00613         if (!obj)
00614             return false;
00615 
00616         cstr_lock(obj);
00617 
00618         if (obj->length == 0)
00619         {
00620             cstr_unlock(obj);
00621             return false;
00622         }
00623 
00624         obj->data[obj->length - 1] = 0;
00625         obj->length--;
00626 
00627         cstr_unlock(obj);
00628 
00629         return true;
00630     }
00631 
00638     bool cstr_append_cstr(_In_ CString* obj, _In_ CString* obj2)
00639     {
00640         if (!obj || !obj2)
00641             return false;
00642 
00643         cstr_lock(obj);
00644 
00645         size_t new_length = obj->length + obj2->length;
00646         size_t required_capacity = new_length + 1;
```

```
00647
00648         if (required_capacity > obj->capacity)
00649         {
00650             if (!cstr_resize(obj, required_capacity))
00651             {
00652                 cstr_unlock(obj);
00653                 return false;
00654             }
00655         }
00656
00657         memcpy(obj->data + obj->length, obj2->data, obj2->length);
00658         obj->data[new_length] = '\0';
00659         obj->length = new_length;
00660
00661         cstr_unlock(obj);
00662
00663         return true;
00664     }
00665
00672     bool cstr_append_chars(_In_ CString* obj, _In_ const char* data)
00673     {
00674         if (!obj || !data)
00675             return false;
00676
00677         cstr_lock(obj);
00678
00679         size_t data_len = strlen(data);
00680         size_t new_length = obj->length + data_len;
00681         size_t required_capacity = new_length + 1;
00682
00683         if (required_capacity > obj->capacity)
00684         {
00685             if (!cstr_resize(obj, required_capacity))
00686             {
00687                 cstr_unlock(obj);
00688                 return false;
00689             }
00690         }
00691
00692         memcpy(obj->data + obj->length, data, data_len);
00693         obj->data[new_length] = '\0';
00694         obj->length = new_length;
00695
00696         cstr_unlock(obj);
00697
00698         return true;
00699     }
00700
00708     bool cstr_append_wchars(_In_ CString* obj, _In_ const wchar_t* data)
00709     {
00710         if (!obj || !data)
00711             return false;
00712
00713         cstr_lock(obj);
00714
00715         int len = WideCharToMultiByte(CP_ACP, 0, data, -1, NULL, 0, NULL, NULL);
00716         if (len == 0)
00717         {
00718             cstr_unlock(obj);
00719             return false;
00720         }
00721
00722         char* mb_data = (char*)malloc(len);
00723         if (!mb_data)
00724         {
00725             cstr_unlock(obj);
00726             return false;
00727         }
00728
00729         if (WideCharToMultiByte(CP_ACP, 0, data, -1, mb_data, len, NULL, NULL) == 0)
00730         {
00731             free(mb_data);
00732             cstr_unlock(obj);
00733             return false;
00734         }
00735
00736         size_t data_len = strlen(mb_data);
00737         size_t new_length = obj->length + data_len;
00738         size_t required_capacity = new_length + 1;
00739
00740         if (required_capacity > obj->capacity)
00741         {
00742             if (!cstr_resize(obj, required_capacity))
00743             {
00744                 free(mb_data);
00745                 cstr_unlock(obj);
00746                 return false;
```

```
00747             }
00748         }
00749
00750         memcpy(obj->data + obj->length, mb_data, data_len);
00751         obj->data[new_length] = '\0';
00752         obj->length = new_length;
00753
00754         free(mb_data);
00755
00756         cstr_unlock(obj);
00757
00758         return true;
00759     }
00760
00770     bool cstr_substring(_In_ CString* obj, _Inout_ CString* dest, _In_ size_t start, _In_ size_t
      length)
00771     {
00772         if (!obj || !dest)
00773             return false;
00774
00775         cstr_lock(obj);
00776
00777         if (start >= obj->length)
00778         {
00779             cstr_unlock(obj);
00780             return false;
00781         }
00782
00783         size_t max_length = obj->length - start;
00784         if (length > max_length)
00785             length = max_length;
00786
00787         char* buffer = (char*)malloc(length + 1);
00788         if (!buffer)
00789         {
00790             cstr_unlock(obj);
00791             return false;
00792         }
00793
00794         memcpy(buffer, obj->data + start, length);
00795         buffer[length] = '\0';
00796
00797         if (!cstr_create_from_chars(dest, buffer))
00798         {
00799             free(buffer);
00800             cstr_unlock(obj);
00801             return false;
00802         }
00803
00804         free(buffer);
00805
00806         cstr_unlock(obj);
00807
00808         return true;
00809     }
00810
00818     bool cstr_erase(_In_ CString* obj, _In_ size_t index, _In_ size_t size)
00819     {
00820         if (!obj)
00821             return false;
00822
00823         cstr_lock(obj);
00824
00825         if (index >= obj->length || size == 0)
00826         {
00827             cstr_unlock(obj);
00828             return false;
00829         }
00830
00831         if (size > obj->length - index)
00832             size = obj->length - index;
00833
00834         size_t new_length = obj->length - size;
00835         size_t move_size = (obj->length - (index + size)) + 1;
00836
00837         memmove(obj->data + index, obj->data + index + size, move_size);
00838         obj->length = new_length;
00839
00840         cstr_unlock(obj);
00841
00842         return true;
00843     }
00844
00852     bool cstr_insert(_In_ CString* obj, _In_ size_t index, _In_ char chr)
00853     {
00854         if (!obj)
00855             return false;
```

```
00856
00857         cstr_lock(obj);
00858
00859         if (index > obj->length)
00860         {
00861             cstr_unlock(obj);
00862             return false;
00863         }
00864
00865         size_t new_length = obj->length + 1;
00866         size_t required_capacity = new_length + 1;
00867
00868         if (required_capacity > obj->capacity)
00869         {
00870             if (!cstr_resize(obj, required_capacity))
00871             {
00872                 cstr_unlock(obj);
00873                 return false;
00874             }
00875         }
00876
00877
00878         memmove(obj->data + index + 1, obj->data + index, (obj->length - index) + 1);
00879         obj->data[index] = chr;
00880         obj->length = new_length;
00881
00882         cstr_unlock(obj);
00883
00884         return true;
00885     }
00886
00893     bool cstr_swap(_In_ CString* obj, _In_ CString* obj2)
00894     {
00895         if (!obj || !obj2)
00896             return false;
00897
00898         cstr_lock(obj);
00899         cstr_lock(obj2);
00900
00901         char* temp_data = obj->data;
00902         obj->data = obj2->data;
00903         obj2->data = temp_data;
00904
00905         size_t temp_length = obj->length;
00906         obj->length = obj2->length;
00907         obj2->length = temp_length;
00908
00909         size_t temp_capacity = obj->capacity;
00910         obj->capacity = obj2->capacity;
00911         obj2->capacity = temp_capacity;
00912
00913         cstr_unlock(obj2);
00914         cstr_unlock(obj);
00915
00916         return true;
00917     }
00918
00925     size_t cstr_find_cstr(_In_ CString* obj, _In_ CString* obj2)
00926     {
00927         if (!obj || !obj2)
00928             return invalid;
00929
00930         cstr_lock(obj);
00931         cstr_lock(obj2);
00932
00933         char* pos = strstr(obj->data, obj2->data);
00934         size_t out = (pos != NULL) ? (size_t)(pos - obj->data) : invalid;
00935
00936         cstr_unlock(obj2);
00937         cstr_unlock(obj);
00938
00939         return out;
00940     }
00941
00948     size_t cstr_find_chars(_In_ CString* obj, _In_ const char* data)
00949     {
00950         if (!obj || !data)
00951             return invalid;
00952
00953         cstr_lock(obj);
00954
00955         char* pos = strstr(obj->data, data);
00956         size_t out = (pos != NULL) ? (size_t)(pos - obj->data) : invalid;
00957
00958         cstr_unlock(obj);
00959
00960         return out;
```

```
00961     }
00962
00970     size_t cstr_find_wchars(_In_ CString* obj, _In_ const wchar_t* data)
00971     {
00972         if (!obj || !data)
00973             return invalid;
00974
00975         int len = WideCharToMultiByte(CP_ACP, 0, data, -1, NULL, 0, NULL, NULL);
00976         if (len == 0)
00977             return invalid;
00978
00979         char* mb_data = (char*)malloc(len);
00980         if (!mb_data)
00981             return invalid;
00982
00983         if (WideCharToMultiByte(CP_ACP, 0, data, -1, mb_data, len, NULL, NULL) == 0)
00984         {
00985             free(mb_data);
00986             return invalid;
00987         }
00988
00989         cstr_lock(obj);
00990
00991         char* pos = strstr(obj->data, mb_data);
00992         size_t result = (pos != NULL) ? (size_t)(pos - obj->data) : invalid;
00993
00994         cstr_unlock(obj);
00995
00996         free(mb_data);
00997
00998         return result;
00999     }
01000
01006     bool cstr_to_upper(_In_ CString* obj)
01007     {
01008         if (!obj)
01009             return false;
01010
01011         cstr_lock(obj);
01012
01013         for (size_t i = 0; i < obj->length; ++i)
01014             obj->data[i] = (char)toupper((unsigned char)obj->data[i]);
01015
01016         cstr_unlock(obj);
01017
01018         return true;
01019     }
01020
01026     bool cstr_to_lower(_In_ CString* obj)
01027     {
01028         if (!obj)
01029             return false;
01030
01031         cstr_lock(obj);
01032
01033         for (size_t i = 0; i < obj->length; ++i)
01034             obj->data[i] = (char)tolower((unsigned char)obj->data[i]);
01035
01036         cstr_unlock(obj);
01037
01038         return true;
01039     }
01040
01046     bool cstr_trim(_In_ CString* obj)
01047     {
01048         if (!obj)
01049             return false;
01050
01051         cstr_lock(obj);
01052
01053         if (obj->length == 0)
01054         {
01055             cstr_unlock(obj);
01056             return false;
01057         }
01058
01059         size_t start = 0;
01060         size_t end = obj->length - 1;
01061
01062         while (start <= end && isspace((unsigned char)obj->data[start]))
01063             start++;
01064
01065         while (end >= start && isspace((unsigned char)obj->data[end]))
01066             end--;
01067
01068         size_t new_length = (start <= end) ? (end - start + 1) : 0;
01069
```

```
01070         if (start > 0)
01071             memmove(obj->data, obj->data + start, new_length);
01072 
01073         obj->data[new_length] = '\0';
01074         obj->length = new_length;
01075 
01076         cstr_unlock(obj);
01077 
01078         return true;
01079     }
01080 
01089     bool cstr_tokenize(_In_ CString* obj, _Inout_ CString* token, _In_ const char* delimiters, _Inout_
      size_t* start_pos)
01090     {
01091         if (!obj || !delimiters || !start_pos || *start_pos >= obj->length)
01092             return false;
01093 
01094         cstr_lock(obj);
01095 
01096         size_t len = obj->length;
01097         size_t pos = *start_pos;
01098 
01099         while (pos < len && strchr(delimiters, obj->data[pos]) != NULL)
01100             pos++;
01101 
01102         if (pos >= len)
01103         {
01104             *start_pos = pos;
01105             cstr_unlock(obj);
01106             return false;
01107         }
01108 
01109         size_t token_start = pos;
01110 
01111         while (pos < len && strchr(delimiters, obj->data[pos]) == NULL)
01112             pos++;
01113 
01114         size_t token_end = pos;
01115 
01116         size_t token_len = token_end - token_start;
01117         char* temp = (char*)malloc(token_len + 1);
01118         if (!temp)
01119         {
01120             cstr_unlock(obj);
01121             return false;
01122         }
01123 
01124         memcpy(temp, obj->data + token_start, token_len);
01125         temp[token_len] = '\0';
01126 
01127         if (!cstr_create_from_chars(token, temp))
01128         {
01129             free(temp);
01130             cstr_unlock(obj);
01131             return false;
01132         }
01133 
01134         free(temp);
01135 
01136         *start_pos = (token_end < len) ? token_end + 1 : len;
01137 
01138         cstr_unlock(obj);
01139 
01140         return true;
01141     }
01142 
01161     bool cstr_tokenize_ex(_In_ CString* obj, _Inout_ CString* token, _In_ const char* delimiters, _In_
      const char* zone_pairs, _In_ const char* escape_chars, _Inout_ size_t* start_pos)
01162     {
01163         if (!obj || !delimiters || !start_pos || *start_pos >= obj->length)
01164             return false;
01165 
01166         cstr_lock(obj);
01167 
01168         size_t len = obj->length;
01169         size_t pos = *start_pos;
01170 
01171         while (pos < len && strchr(delimiters, obj->data[pos]) != NULL)
01172             pos++;
01173 
01174         if (pos >= len)
01175         {
01176             *start_pos = pos;
01177             cstr_unlock(obj);
01178             return false;
01179         }
01180 
```

```
01181         size_t token_start = pos;
01182         size_t token_end = invalid;
01183         bool in_zone = false;
01184         char zone_end = '\0';
01185         bool escape = false;
01186 
01187         for (; pos < len; pos++)
01188         {
01189             char c = obj->data[pos];
01190 
01191             if (escape)
01192             {
01193                 escape = false;
01194                 continue;
01195             }
01196 
01197             if (in_zone)
01198             {
01199                 if (c == zone_end)
01200                 {
01201                     in_zone = false;
01202                     zone_end = '\0';
01203                 }
01204             }
01205             else
01206             {
01207                 if (strchr(delimiters, c) != NULL)
01208                 {
01209                     token_end = pos;
01210                     break;
01211                 }
01212 
01213                 if (zone_pairs)
01214                 {
01215                     for (int z = 0; zone_pairs[z] != '\0'; z += 2)
01216                     {
01217                         if (zone_pairs[z + 1] == '\0')
01218                             break;
01219                         if (c == zone_pairs[z])
01220                         {
01221                             in_zone = true;
01222                             zone_end = zone_pairs[z + 1];
01223                             break;
01224                         }
01225                     }
01226                 }
01227 
01228                 if (escape_chars && strchr(escape_chars, c) != NULL)
01229                     escape = true;
01230             }
01231         }
01232 
01233         token_end = (pos == len) ? len : token_end;
01234 
01235         size_t token_len = token_end - token_start;
01236         char* temp = (char*)malloc(token_len + 1);
01237         if (!temp)
01238         {
01239             cstr_unlock(obj);
01240             return false;
01241         }
01242 
01243         memcpy(temp, obj->data + token_start, token_len);
01244         temp[token_len] = '\0';
01245 
01246         if (!cstr_create_from_chars(token, temp))
01247         {
01248             free(temp);
01249             cstr_unlock(obj);
01250             return false;
01251         }
01252 
01253         free(temp);
01254         *start_pos = (token_end < len) ? token_end + 1 : len;
01255 
01256         cstr_unlock(obj);
01257 
01258         return true;
01259     }
01260 
01261 #ifdef __cplusplus
01262 }
01263 #endif
01264 
01265 #endif // CSTR_H
```

Index