

Generic ClearSilver and GLib Module Build Support

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Abstract

This document provides generic ClearSilver¹ and GLib² support for my generic build system. It also provides some useful generic template extensions.

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```
$Id: build.nw 197 2012-12-06 05:02:53Z darktjm $  
$Id: cs-glib.nw 198 2012-12-07 05:40:28Z darktjm $
```

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1 Memory Allocation

There are a number of dynamic array facilities and memory allocation techniques that I tend to reimplement with every project. However, the GLib library provides many of the facilities I most commonly use, like dynamic arrays, dynamic strings, linked lists of buffers, and linked list of buffers with hash table duplication removal. Although some implementations are not as efficient as they could be, using them reduces the overall size of code that needs to be maintained. Support is provided here for that library — in particular, the ones provided with Red Hat Enterprise Linux 4 (2.4.7) and Red Hat Enterprise Linux 5 (2.12.3).

¹<http://www.clearsilver.net/>; version 0.10.5+ is required. The 0.10.3 and 0.10.4 versions from EPEL are buggy and missing the automatic escape mechanisms.

²<http://www.gtk.org/>

```
1 <(build.nw) Common C Includes 1>≡ (46a) 2d>
  #include <glib.h>
```

```
2a <(build.nw) makefile.vars 2a>≡ 2b>
  GLIB_CFLAGS:=$(shell pkg-config --silence-errors gthread-2.0 --cflags || \
    pkg-config glib-2.0 "--cflags")
  GLIB_LDFLAGS:=$(shell pkg-config --silence-errors gthread-2.0 --libs || \
    pkg-config glib-2.0 --libs)
```

```
2b <(build.nw) makefile.vars 2a>+≡ <2a 7c>
  EXTRA_CFLAGS += $(GLIB_CFLAGS)
  EXTRA_LDFLAGS += $(GLIB_LDFLAGS)
```

One thing that is missing that I have always found useful is a version of `fgets(3)` which supports dynamic strings. Such a function is easy enough to implement, so here it is. A generic version is provided as well for cases where `fgets`-equivalent functions are available.

When reading binary data that may contain NUL characters, the buffer length must be updated based not on `strlen`, but on the number of characters read. This can be obtained from `ftell` only for seekable streams, so the only option with `fgets` is to fill the memory with non-NUL characters and search for the last added NUL. Another option would be to use a different reader function. The CPU overhead for using `getc` for every character is pretty high, though, and `fscanf` has issues with NUL characters as well. Implementing a wrapper around `fread` would require that all reads from the file be done using this function in order to take care of backlog.

In order to avoid the processing overhead for NULs for most reads, the wrapper has two names, and the generic function takes a parameter to enable this.

```
2c <(Library glib-supt Members 2c>≡
  g_string_fgets.o
```

```
2d <(build.nw) Common C Includes 1>+≡ (46a) <1 4c>
  #include "g_string_fgets.h"
```

```
2e <g_string_fgets.h 2e>≡
  /*
   * <(build.nw) Common NoWeb Warning 3c>
   */
  #ifndef _G_STRING_FGETS_H
  #define _G_STRING_FGETS_H
  <gets_fp definition 2f>
  #endif /* _G_STRING_FGETS_H */
```

```
2f <gets_fp definition 2f>≡ (2e)
  typedef char *(*gets_fp)(char *buf, int len, void *f);
```

```
2g <(build.nw) Known Data Types 2g>≡ 5c>
  gets_fp, %
```

2h `<(g_string_fgets.c 2h)>`

```

<(build.nw) Common C Header 16c>

char *g_string_fgets(GString **_buf, guint offset, FILE *f)
{
    return g_string_gets_generic(_buf, offset, (gets_fp)fgets, f, FALSE);
}

char *g_string_fgets_bin(GString **_buf, guint offset, FILE *f)
{
    return g_string_gets_generic(_buf, offset, (gets_fp)fgets, f, TRUE);
}

char *g_string_gets_generic(GString **_buf, guint offset, gets_fp my_gets,
                           void *f, gboolean allow_zero)
{
    guint left, len;
    GString *buf = *_buf;
    gboolean read_some = FALSE;
    const char *ep;

    if(!_buf)
        buf = *_buf = g_string_sized_new(offset + 80);
    else if(buf->allocated_len <= offset)
        g_string_set_size(buf, offset + 80);
    while(1) {
        left = buf->allocated_len - offset;
        if(allow_zero)
            memset(buf->str + offset, 255, left);
        else /* still need to detect end of line */
            buf->str[offset + left - 1] = 255;
        if(!(*my_gets)(buf->str + offset, left, f)) {
            buf->str[offset] = 0;
            break;
        }
        read_some = TRUE;
        if(allow_zero) {
            /* memchr is GNU extension, so this is done manually */
            /* guaranteed to terminate */
            for(ep = buf->str + buf->allocated_len - 1; *ep; ep--);
            len = (int)(ep - buf->str) - offset;
        } else
            len = strlen(buf->str + offset);
        left -= len;
        offset += len;
        if((left > 1 && buf->str[offset + left - 1]) ||
            buf->str[offset - 1] == '\n')
            break;
        g_string_set_size(buf, buf->allocated_len * 2 - 1);
    }
    buf->len = offset;
    return read_some ? buf->str : NULL;
}

```

3a `<(build.nw) Version Strings 3a>`

```
$Id: cs-glib.nw 198 2012-12-07 05:40:28Z darktjm $ \n"
```

3b `<(build.nw) Sources 3b>`

```
$Id: cs-glib.nw 198 2012-12-07 05:40:28Z darktjm $
```

3c *<(build.nw) Common NoWeb Warning 3c>≡*

(2e 47b)

```
# $Id: cs-glib.nw 198 2012-12-07 05:40:28Z darktjm $
```

Its main disadvantage for server-like processes is that it aborts the entire program on memory failures rather than returning an error so that the caller can recover gracefully. If this is an issue, a process monitor, such as `init(8)`, can take care of this problem. Another memory allocation issue is that GLib uses 32-bit integers in some places, and does not check for integer overflow, so some errors are never caught except by segmentation fault³. This can be avoided by running these processes with "`ulimit -v <size>`" in effect on Linux, or "`ulimit -d <size>`" in effect on AIX, where `<size>` is at most a small (≤ 3) multiple of 1048576 (1GB). The following script can be used to support starting processes in `init(8)`. It checks to see if a file in `/tmp` has been touched before continuing, so that the file can be touched before killing a process for maintenance.

4a *<runit 4a>≡*

```
#!/bin/sh

prog_to_run="$1"
type "$prog_to_run" >/dev/null 2>&1 || exit 1
shift
prog_to_run_base="${prog_to_run##*/}"
while [ -f "/tmp/stop_${prog_to_run_base}" ]; do
    sleep 60
done

# Use -v on Linux, -d on AIX
ulimit -v $((2*1024*1024)) 2>/dev/null || ulimit -d $((2*1024*1024))
if type gawk >/dev/null 2>&1; then
    exec "$prog_to_run" "$@" 2>&1 | \
        gawk '{ print strftime("%Y-%m-%d %H:%M:%S"), $0; fflush(); }'
else
    exec "$prog_to_run" "$@"
fi
```

4b *<(build.nw) Script Executables 4b>≡*

```
runit \
```

2 Logging

One way to deal with logs is to not deal with them, and instead just dump errors to standard error. While a simple `perror(3)` would be enough (with some extra text from application libraries), the slightly more complex ClearSilver⁴ error facility could be used instead. This provides a partial traceback with little extra effort. As with any method that passes around error messages rather than error codes, though, it will be hard to translate things into a different language. It will also be hard to distinguish between different errors unless separate error codes are used.

³Beyond this, there are some problems in the way UNIX handles too-large requests for memory. UNIX will allocate from swap space, and even (at least on Linux) over-allocate beyond available memory without returning errors. Using `ulimit -v/-d` will cure this as well.

⁴<http://www.clearsilver.net/>; at least version 0.10.5 is required. Older versions are buggy and missing the automatic escape mechanisms.

4c $\langle(\text{build.nw}) \text{ Common C Includes 1}\rangle + \equiv$ (46a) $\langle 2d \ 23a \rangle$

```
#include <time.h> /* for -Wshadow */
#define timezone time_zone /* for -Wshadow */
#include <ClearSilver.h>
#include "cs_supt.h"
```

5a $\langle \text{cs_supt.h 5a} \rangle \equiv$

```
#ifndef _CS_SUPT_H
#define _CS_SUPT_H
<ClearSilver Support Globals 5b>
#endif /* _CS_SUPT_H */
```

5b $\langle \text{ClearSilver Support Globals 5b} \rangle \equiv$ (5a) 5h>

```
extern NERR_TYPE GENERIC_ERR;
#ifdef __GNUC__
#define unused_attr __attribute__((__unused__))
#else
#define unused_attr
#endif
```

5c $\langle(\text{build.nw}) \text{ Known Data Types 2g}\rangle + \equiv$ $\langle 2g \ 11e \rangle$

```
unused_attr, %
```

5d $\langle \text{Library cs-supt Members 5d} \rangle \equiv$ 17a>

```
cs_supt.o
```

5e $\langle \text{cs_supt.c 5e} \rangle \equiv$ 7f>

```
 $\langle(\text{build.nw}) \text{ Common C Header 16c}\rangle$ 
NERR_TYPE GENERIC_ERR = 0;
```

5f $\langle \text{Common Mainline Variables 5f} \rangle \equiv$ (46a)

```
NEOERR *nerr unused_attr = STATUS_OK;
int ret unused_attr = 0;
```

5g $\langle \text{Initialize logging 5g} \rangle \equiv$ (8g)

```
{
    const char *progrname = strrchr(argv[0], '/');

    if(!progrname)
        progrname = argv[0];
    else
        progrname++;
    g_set_prgrname(progrname);
}
nerr = nerr_init();
die_if_err(nerr); /* out of memory - pretty fatal */
nerr_register(&GENERIC_ERR, g_get_prgrname());
```

5h <ClearSilver Support Globals 5b>+≡

(5a) <5b 6c>

```

#define die_if_err(err) do { \
    NEOERR *_err = err; \
    \
    if(_err != STATUS_OK) { \
        nerr_log_error(_err); \
        exit(1); \
    } \
} while(0)

#define nerr_raise_msg(msg) \
    nerr_raise(GENERIC_ERR, "%s", msg)

#define die_msg(msg) \
    die_if_err(nerr_raise_msg(msg))

#define nerr_raise_msg_errno(msg) \
    nerr_raise_errno(GENERIC_ERR, "%s", msg)

#define die_errno(msg) \
    die_if_err(nerr_raise_msg_errno(msg))

#define nerr_raise_errno_local(msg, err) \
    nerr_raise(GENERIC_ERR, "%s: [%d] %s", msg, err, strerror(err))

#define die_errno_local(msg, err) \
    die_if_err(nerr_raise_errno_local(msg, err))

#define nerr_op(op) do { \
    if(nerr == STATUS_OK) \
        nerr = nerr_pass(op); \
} while(0)

#define nerr_op_ok(op) (nerr == STATUS_OK && \
    (nerr = nerr_pass(op)) == STATUS_OK)

```

6a <(build.nw) C Prototypes 6a>≡

7a>

```

void die_if_err(NEOERR *err);
NEOERR *nerr_raise_msg(const char *msg);
void die_msg(const char *msg);
NEOERR *nerr_raise_msg_errno(const char *msg);
void die_errno(const char *msg);
NEOERR *nerr_raise_errno_local(const char *msg, int err);
void die_errno_local(const char *msg, int err);
void nerr_op(NEOERR *op);
gboolean nerr_op_ok(NEOERR *op);

```

6b <Convert nerr to err_str 6b>≡

```

STRING err_str;

string_init(&err_str);
nerr_error_traceback(nerr, &err_str);
nerr_ignore(&nerr);

```

A few GLib functions actually do return error codes (GError *), in which case a macro can be used to convert that into a ClearSilver error.

6c <ClearSilver Support Globals 5b>+≡

(5a) <5h 7d>

```

#define gerr_to_nerr(gerr) \
    ((gerr) ? \

```

6c `<ClearSilver Support Globals 5b>+≡` (5a) `<5h 7d>`

```
nerr_raise(GENERIC_ERR, "%s/%d: %s", \
            g_quark_to_string((gerr)->domain), (gerr)->code, \
            (gerr)->message) : \
STATUS_OK)
```

7a `<(build.nw) C Prototypes 6a>+≡` `<6a 7e>`

```
NEOERR *gerr_to_nerr(const GError *gerr);
```

Actually building with ClearSilver requires knowledge of the library location. This cannot be obtained by pkg-config, so it is an overridable make variable.

7b `<(build.nw) makefile.config 7b>≡` `8b>`

```
# Where to find ClearSilver
CLEARSilver_CFLAGS=-I/usr/include/ClearSilver -I/usr/local/include/ClearSilver
CLEARSilver_LDFLAGS=-L/usr/local/lib -lneo_cgi -lneo_cs -lneo_util -lz
```

7c `<(build.nw) makefile.vars 2a>+≡` `<2b 8c>`

```
EXTRA_CFLAGS += $(CLEARSilver_CFLAGS)
EXTRA_LDFLAGS += $(CLEARSilver_LDFLAGS)
```

3 Configuration

Since GLib doesn't support configuration files until 2.6, a different library is used. The ClearSilver library supports configuration files. It is also somewhat complex and poorly documented, but it is less complex and better documented than some, and provides easy ways to override variables and write out configuration files.

Configuration parameters for a program are always in a section of the configuration file named after the program. This allows a combined configuration file for multiple programs, and since the entire file can be prefixed with the program name fairly easily, it is no great burden on the user. If no configuration file is found, or an option has no entry in the configuration file, a hard-coded default is used.

7d `<ClearSilver Support Globals 5b>+≡` (5a) `<6c 8f>`

```
extern HDF *local_config;

#define getconf(name, def) hdf_get_value(local_config, name, def)
#define getconf_int(name, def) hdf_get_int64_value(local_config, name, def)
```

7e `<(build.nw) C Prototypes 6a>+≡` `<7a 9b>`

```
const char *getconf(const char *name, const char *def);
gint64 getconf_int(const char *name, gint64 def);
```

7f `<cs_supt.c 5e>+≡` `<5e 8a>`

```
HDF *local_config;

gint64 hdf_get_int64_value(HDF *hdf, const char *name, gint64 def)
{
    const char *val = hdf_get_value(hdf, name, NULL);
    char *s;
    gint64 ret;
```

7f `<cs_supt.c 5e>+≡` `<5e 8a>`

```

    if (val && *val) {
        ret = strtoll(val, &s, 0);
        if (*s)
            die_if_err(nerr_raise(GENERIC_ERR, "Expected integer for %s; got %s", name, val));
        return ret;
    } else
        return def;
}

```

8a `<cs_supt.c 5e>+≡` `<7f 11f>`

```

NEOERR *hdf_set_int64_value(HDF *hdf, const char *name, gint64 val)
{
    char nbuf[22]; /* 20 + sign */

    snprintf(nbuf, sizeof(nbuf), "%lld", (long long)val);
    return hdf_set_value(hdf, name, nbuf);
}

```

The configuration file's name and location are application-dependent. These support routines just provide a simple way to read the known name. Common environment variables are provided to override the name: CONFIG_ROOT just overrides the directory, and CONFIG_FILE overrides either the file name or the entire path. The default configuration path is determined by the project name, although the default need not be used.

8b `<(build.nw) makefile.config 7b>+≡` `<7b 20e>`

```

# Installation directory for configuration files
ETC_DIR=/etc/${PROJECT_NAME}

```

8c `<(build.nw) makefile.vars 2a>+≡` `<7c 10a>`

```

EXTRA_CFLAGS += -DETCDIR=' "${ETC_DIR}" ' -DPROJECT_NAME=' "${PROJECT_NAME}" '

```

8d `<(Default config_root 8d)>≡`

```

const char *config_root = ETC_DIR;

```

8e `<(Default config_path 8e)>≡`

```

const char *config_path = PROJECT_NAME ".conf";

```

8f `<(ClearSilver Support Globals 5b)>+≡` `(5a) <7d 9a>`

```

/* define in mainline */
extern const char *config_root, *config_path;

```

8g `<(Read configuration 8g)>≡` `(46a) 13a>`

```

<(Initialize logging 5g)
env_override("CONFIG_ROOT", config_root);
env_override("CONFIG_FILE", config_path);
prepend_dir_if_relative(config_root, config_path);
{
    HDF *config_file;

    nerr = nerr_pass(hdf_init(&config_file));
    die_if_err(nerr); /* out of memory - pretty fatal */
}

```


8g <Read configuration 8g>≡

(46a) 13a>

```

{
    char *p = strdup(config_path), *s;

    if(!p)
        die_errno("initial setup");
    s = strrchr(p, '/');
    if(s) {
        *s = 0;
        s = p;
    } else
        s = (char *) "."; /* not modified any more */
    nerr = nerr_pass(hdf_set_value(config_file, "hdf.loadpaths.conf", s));
    free(p);
    die_if_err(nerr);
}
nerr = nerr_pass(hdf_read_file(config_file, config_path));
if(nerr != STATUS_OK) {
    /* ignore file not found -- no config file means use default */
    if(!nerr_match(nerr, NERR_NOT_FOUND))
        die_if_err(nerr);
    nerr_ignore(&nerr);
}
nerr_op(hdf_get_node(config_file, g_get_prname(), &local_config));
if(nerr == STATUS_OK) {
    HDF *lp = hdf_get_obj(config_file, "hdf.loadpaths");

    if(lp)
        nerr_op(hdf_copy(local_config, "hdf.loadpaths", lp));
}
die_if_err(nerr); /* out of memory */
}

```

9a <ClearSilver Support Globals 5b>+≡

(5a) <8f 11d>

```

#define env_override(env, var) do { \
    const char *s = getenv((char *)env); \
    \
    if(s) \
        var = s; \
} while(0)

#define prepend_dir_if_relative(def_dir, fn) do { \
    if((fn)[0] != '/') { \
        char *s; \
        \
        if(!(s = malloc(strlen(def_dir) + strlen(fn) + 2))) \
            die_errno(fn); \
        sprintf(s, "%s/%s", def_dir, fn); \
        fn = s; \
    } \
} while(0)

```

9b <(build.nw) C Prototypes 6a>+≡

<7e 12b>

```

void env_override(const char *env, const char *&var);
void prepend_dir_if_relative(const char *def_dir, const char *&fn);

```

A sample commented configuration file should be provided. The ClearSilver documentation does not have a complete specification of the configuration file syntax, so instead of pointing a user at a URL, the relevant parts of the syntax are given as documentation at the top of the sample configuration file.

9c `<ClearSilver Configuration Documentation 9c>≡`

```
# The purpose of this file is to assign values to keys.  The last assignment
# to any key overrides all previous assignments.  This file may provide
# configuration for multiple programs; each program's configuration is
# prefixed by its executable name.  Use links to allow multiple executable
# names to have the same configuration.
# File format:
#   Lines starting with # are comments, unless they are #include
#
#   #include <name> includes another file (<name> can have quotes around it)
#   If you want to use the include path, and want to use #include anywhere but
#   at the top level, add the following line in the same section as the
#   #include:
#       hdf: hdf
#
#   Keys are multiple level names, separated by dots:
#   Key level names are case-sensitive alphanumeric and underscores
#   A key level, followed by an open curly brace, starts a group
#   In the group, all entries are prefixed by the level before the brace
#   For example:
#       x {
#           y ...
#           z ...
#       }
#   is the same as
#       x.y ...
#       x.z ...
#
#   Values can either be literal values, inline data, or other keys
#   Literal values are assigned with <key> = <value> (no escapes)
#   Inline data is assigned by <key> << <token>
#       ... (literal data, no escapes, always includes a final newline)
#       <token>
#   A copy of another key's current value is created by <key> := <other key>
#   A link to another key that tracks changes is created by <key> : <other key>
#   Numeric values are C-style decimal ([1-9][0-9]*), octal (0[0-9]*) and
#   hexadecimal (0x[0-9a-fA-F]+).
#
#   Initial and trailing whitespace is ignored on all lines except inline data
#   Whitespace surrounding =, :=, :, <<, and { is ignored
#   Whenever key levels are sorted, they are interpreted as numbers first, if
#   possible.  Numbers always come before alphanumerics.
```

In order to support the multi-line literal syntax when using `notangle`, the end of each multi-line literal must be shifted all the way to the left margin. For this build procedure, only `EOV` is supported as an end token.

10a `<(build.nw) makefile.vars 2a>+≡` `<8c 14a>`

```
HDF_FILES=<HDF Files 11b>
```

10b `<(build.nw) Build Source 10b>≡` `15f>`

```
$ (HDF_FILES) \
```

10c `<(build.nw) makefile.rules 10c>≡` `11a>`

```
misc: $(HDF_FILES)
$(HDF_FILES): $(NOWEB_ORDER)
    notangle -R$@ $^ | sed 's/^ *EOV/EOV/' > $@
distclean: cleanhdf
cleanhdf:
```

10c $\langle(\text{build.nw}) \text{makefile.rules } 10\text{c}\rangle \equiv$ 11a \rangle

```
rm -f $(HDF_FILES)
```

11a $\langle(\text{build.nw}) \text{makefile.rules } 10\text{c}\rangle + \equiv$ $\langle 10\text{c } 15\text{e}\rangle$

```
misc: $(HDF_FILES)
```

11b $\langle\text{HDF Files } 11\text{b}\rangle \equiv$ (10a)

```
\
```

11c $\langle(\text{build.nw}) \text{Install other files } 11\text{c}\rangle \equiv$

```
$ (if $(HDF_FILES), \
mkdir -p $(DESTDIR)$ (ETC_DIR); \
for x in $(HDF_FILES); do \
  cp -p $$x $(DESTDIR)$ (ETC_DIR)/$$x.sample; \
  test -f $(DESTDIR)$ (ETC_DIR)/$$x || cp -p $$x $(DESTDIR)$ (ETC_DIR); \
done)
```

The sorting mentioned in the commentary above is implemented by a comparison function for `hdf_sort_obj`.

11d $\langle\text{ClearSilver Support Globals } 5\text{b}\rangle + \equiv$ (5a) $\langle 9\text{a } 12\text{a}\rangle$

```
/* These type names are too long, so here's shorter versions */
typedef long long llong;
typedef unsigned long long ullong;
```

11e $\langle(\text{build.nw}) \text{Known Data Types } 2\text{g}\rangle + \equiv$ $\langle 5\text{c } 15\text{b}\rangle$

```
ullong, llong, %
```

11f $\langle\text{cs_supt.c } 5\text{e}\rangle + \equiv$ $\langle 8\text{a } 12\text{c}\rangle$

```
int comp_hdf_name(const void *_a, const void *_b)
{
    HDF * const *a = _a, * const *b = _b;
    const char *na = hdf_obj_name(*a), *nb = hdf_obj_name(*b);
    char *ea, *eb;
    ullong la, lb;
    int c;

    /* empty should never happen, but comes first */
    if (!*na && !*nb)
        return 0;
    if (!*na)
        return -1;
    if (!*nb)
        return 1;
    /* next come pure numbers (C-style dec, hex, oct) */
    la = strtoll(na, &ea, 0);
    lb = strtoll(nb, &eb, 0);
    if (!*ea && *eb)
        return -1;
    if (!*eb && *ea)
        return 1;
    /* can't just return la - lb, since they're not int */
    /* also, don't want different number formats to sort randomly */
```

11f `<cs_supt.c 5e>+≡` `<8a 12c>`

```

    if (!*ea) {
        if (la < lb)
            return -1;
        else if (la > lb)
            return 1;
    }
    /* then comes strcasecmp() (somewhat locale-sensitive) */
    c = strcasecmp(na, nb);
    if (c)
        return c;
    /* finally, strcmp ensures that the case-sensitive names are not */
    /* shuffled by strcasecmp */
    return strcmp(na, nb);
}

```

A few additional convenience functions for hierarchical parameters are provided, as well.

12a `<ClearSilver Support Globals 5b>+≡` `(5a) <11d 14c>`

```

#define getconf_first(name) hdf_first_child(local_config, name)
#define getconf_first_sorted(name) hdf_first_child_sort(local_config, name)

```

12b `<(build.nw) C Prototypes 6a>+≡` `<9b`

```

HDF *getconf_first(const char *name);
HDF *getconf_first_sorted(const char *name);

```

12c `<cs_supt.c 5e>+≡` `<11f 14b>`

```

HDF *hdf_first_child(HDF *hdf, const char *name)
{
    if (!(hdf = hdf_get_obj(hdf, name)))
        return hdf;
    return hdf_obj_child(hdf);
}

HDF *hdf_first_child_sort(HDF *hdf, const char *name)
{
    if (!(hdf = hdf_get_obj(hdf, name)))
        return hdf;
    hdf_sort_obj(hdf, comp_hdf_name);
    return hdf_obj_child(hdf);
}

gint64 getconf_hier_int(const char *parent, HDF *obj, const char *name,
                       gint64 def)
{
    const char *val = hdf_get_value(obj, name, NULL);
    char *s;
    gint64 ret;

    if (val && *val) {
        ret = strtoll(val, &s, 0);
        if (*s)
            die_if_err(nerr_raise(GENERIC_ERR, "Expected integer for %s.%s.%s; got %s",
                                   parent, hdf_obj_name(obj), name, val));
        return ret;
    }
    else
        return def;
}

```

Command-line options of the form *var=val* can be used to override configuration options from the file and defaults, where *var* is the configuration parameter name under the local section, and *val* is the value. Additional configuration files, which, like the command-line overrides, are overrides for the command-specific options, can be given on the command-line by prefixing the file name with a colon (:). Standard input can be specified using a dash (-). Invalid options cause the command-line help to appear.

13a <Read configuration 8g>+≡

(46a) <8g 14d>

```
while (nerr == STATUS_OK && argc > 1) {
    const char *s;
    char *vn;

    argc--;
    s = **++argv;
    if (*s == ':' && s[1]) {
        s++;
        if (*s == '-' && !s[1]) {
            GString *cfile = NULL;

            while (g_string_fgets(&cfile, cfile ? cfile->len : 0, stdin));
            nerr_op(hdf_read_string(local_config, cfile->str));
            g_string_free(cfile, TRUE);
        } else
            nerr_op(hdf_read_file(local_config, s));
        if (nerr != STATUS_OK) {
            nerr_log_error(nerr);
            help();
        }
        continue;
    }
    if (!isalpha(*s))
        help();
    while (isalnum(*s) || *s == '_' || *s == '.')
        s++;
    if (*s != '=')
        help();
    vn = strdup(*argv);
    vn[(int)(s - *argv)] = 0;
    nerr_op(hdf_set_value(local_config, vn, s + 1));
    free(vn);
}
if (nerr != STATUS_OK) { /* out of memory */
    nerr_log_error(nerr);
    exit(1);
}
```

The default help consists mostly of the appropriate section from the default configuration file with the keyword/value pairs uncommented. This is inserted into the C file as string literals after being extracted from the NoWeb file. The actual text to extract consists of two chunks: <program> *Description* (imported), which is a one-line description, and <program> *Configuration* (imported), which is the contents of the program-specific configuration file section.

13b <Help Function 13b>≡

```
void help(void)
{
    fprintf(stderr, "%s: __PROGDESC__\n\n", g_get_prgname());
    fprintf(stderr, "Usage: %s [<keyword>=<value>|:<file> ...]\n\n"
        "      :<file> specifies parameters to be read from a file "
        "      (- = standard input),\n"
        "      one per line; see default configuration file "
        "      for additional syntax\n\n"
        "Supported keywords and their built-in defaults:\n\n");
}
```


generated by using `-gperf-nc-` instead of `-gperf-`; the `nc-` part is not considered to be part of the *suffix*. Note that the use of `\U` to do the upper-case conversions is a GNU sed extension.

15a `<(ClearSilver Support Globals 5b)>+≡` (5a) `<14c 23b>`

```
struct gperf_name_id {
    int name, id;
};
```

15b `<(build.nw) Known Data Types 2g>+≡` `<11e 28b>`

```
gperf_name_id, %
```

15c `<(build.nw) makefile.vars 2a>+≡` `<14a 19e>`

```
GPERF_PREFIX:= $(shell $(NOROOT) $(NOWEB_ORDER) | tr -d '<>' | \
    fgrep -- -gperf- | sed 's/-gperf-.*//' | sort -u)
GPERF_C := $(GPERF_PREFIX:%=.c.gperf)
GPERF_H := $(GPERF_PREFIX:%=.h.gperf)
GPERF_FILES := $(GPERF_H) $(GPERF_C)
```

15d `<(build.nw) Clean temporary files 15d>≡` `48c>`

```
rm -f $(GPERF_FILES)
```

15e `<(build.nw) makefile.rules 10c>+≡` `<11a 16a>`

```
$(GPERF_C) : $(NOWEB_ORDER)
    @# This for loop is a replacemnt for just setting root= to avoid
    @# makepp stupidity (otherwise it adds root's value as dep)
    @#root=$(@:%.c.gperf=%)
    for root in $(@:%.c.gperf=%); do \
        noroots $(NOWEB_ORDER) | tr -d '<>' | grep \^${root}-gperf- | \
        while read r; do \
            n=${r##${root}-gperf-}; \
            nc=; case $n in nc-*) nc=--ignore-case; n=${n#nc-}; esac; \
            (notangle -Rgperf-prefix $(NOWEB_ORDER) ; \
            notangle -R${r} $(NOWEB_ORDER) | tr \ \n | sort -u | \
            sed -e "h;s/^/${n}_/;s/.*/\U\0/s/[^A-Z0-9\n]/_/g;s/^/,/;H;g" \
                -e "s/\n//"; \
            echo %%; \
            notangle -R'Actual gperf lookup function' $(NOWEB_ORDER)) | \
            gperf $$nc | sed "s/___GPERF_NAME___/${n}/g"; \
        done >$@; done

$(GPERF_H) : $(NOWEB_ORDER)
    @# This for loop is a replacemnt for just setting root= to avoid
    @# makepp stupidity (otherwise it adds root's value as dep)
    @#root=$(@:%.h.gperf=%)
    for root in $(@:%.h.gperf=%); do \
        noroots $(NOWEB_ORDER) | tr -d '<>' | grep \^${root}-gperf- | \
        while read r; do \
            n=${r##${root}-gperf-}; n=${n#nc-}; \
            echo typedef enum \{; \
            echo UNKNOWN_ 'echo $$n | tr '[a-z]-' '[A-Z]_'; \
            notangle -R${r} $(NOWEB_ORDER) | tr \ \n | sort -u | \
            sed "s/^/${n}_/;s/.*/\U\0/s/[^A-Z0-9\n]/_/g;s/^/,/"; \
            echo \} ${n}_t\;; \
        done >$@; done
```

15f `<(build.nw) Build Source 10b>+≡` `<10b 19f>`

```
$(GPERF_FILES) \
```

The prototypes for the lookup functions are generated separately, because the gperf files need to be handled differently from normal C files. The fact that they are included in files that have already had their prototypes generated does not matter, because cproto will not generate prototypes for included files. Reinserting prototypes from the separate prototype file is not possible, so `<(build.nw) C Prototypes 6a>` must be used, instead.

16a `<(build.nw) makefile.rules 10c>+≡` `<15e 20b>`

```
gperf-proto.h: $(GPERF_FILES)
    echo '#include <string.h>' | cat - $(GPERF_FILES) | \
    cproto -E "$(CC) $(CFLAGS) $(EXTRA_CFLAGS) -x c -E" - >$@

$(COFILES): gperf-proto.h
```

16b `<(build.nw) C Headers 16b>≡`

```
gperf-proto.h \
```

16c `<(build.nw) Common C Header 16c>≡` `(2h 5e 17b)`

```
#include "gperf-proto.h"
```

The options are sent to gperf via the header, except for the case-insensitive option sent on the command line above.

16d `<gperf-prefix 16d>≡`

```
%pic
%struct-type
%omit-struct-type
#define hash-function-name __GPERF_NAME__hash
#define lookup-function-name __GPERF_NAME__name_id
#define string-pool-name __GPERF_NAME__strs
%compare-lengths
%readonly-tables
%enum
#define word-array-name __GPERF_NAME__words
struct gperf_name_id;
%%
```

The actual lookup function returns just the ID rather than the internal, otherwise useless structure. No equivalent function is provided for converting IDs back to strings, though. The internal lookup function is suppressed for GNU environments, because the functions are declared inline, and cproto ignores such functions.

16e `<(Actual gperf lookup function 16e)>≡`

```
__GPERF_NAME__t __GPERF_NAME__id(const char *name, int len)
{
    const struct gperf_name_id *hv = __GPERF_NAME__name_id(name, len);
    return hv ? hv->id : 0; /*UNKNOWN__GPERF_NAME__*/
}
```


4 Templates

Templates can either be strings or files, and be dumped to either an open file descriptor or a string. Templates used for displaying to the user generally have a default encoding method of HTML, but templates used for configuration need to be evaluated raw. A flag allows selection of raw mode. The HDF must be provided, even though it will usually just be `local_config`. Since the output parameters are only used by one function call, the input is processed by a generic function that takes the same callback parameters as the output function.

17a <5d

```
templ.o
```

17b 17c>

```
<(build.nw) Common C Header 16c>
```

17c <17b 18a>

```
NEOERR *templ_string_to(const char *tmpl, HDF *parms, CSOUTFUNC outf,
                        void *outp, gboolean raw)
{
    CSPARSE *cs = NULL;
    NEOERR *nerr = STATUS_OK;
    char *tdup;

    <Set raw template parms 17d>
    nerr_op(prepare_template(&cs, parms));
    if (nerr != STATUS_OK) {
        <Free raw template parms 17e> /* memory probs, so don't try to restore */
        return nerr_pass_ctx(nerr, "%s", tmpl);
    }
    /* modified by cs_parse_string; freed by cs_destroy */
    tdup = strdup(tmpl);
    if (!tdup)
        nerr = nerr_raise_msg_errno("No memory for template");
    else
        nerr = nerr_pass(cs_parse_string(cs, tdup, strlen(tmpl)));
    nerr_op(cs_render(cs, outp, outf));
    cs_destroy(&cs);
    <Restore non-raw template parms 17f>
    return nerr_pass_ctx(nerr, "%s", tmpl);
}
```

17d (17c 19c)

```
char *oescape = NULL;

if (raw) {
    nerr_op(hdf_get_copy(parms, "Config.VarEscapeMode", &oescape, NULL));
    nerr_op(hdf_set_value(parms, "Config.VarEscapeMode", "none"));
}
```

17e (17c 19c)

```
if (oescape)
    free(oescape);
```

17f *<Restore non-raw template parms 17f>≡* (17c 19c)

```
if(raw) {
    NEOERR *ignerr;

    if(oescape)
        ignerr = hdf_set_buf(parms, "Config.VarEscapeMode", oescape);
    else
        ignerr = hdf_remove_tree(parms, "Config.VarEscapeMode");
    if(ignerr != STATUS_OK)
        nerr_log_error(ignerr);
}
```

18a *<impl.c 17b>+≡* <17c 18b>

```
NEOERR *prepare_template(CSPARSE **_cs, HDF *hdf)
{
    NEOERR *nerr = nerr_pass(cs_init(_cs, hdf));
    CSPARSE *cs = *_cs;

    <Initialize templates 22a>
    return nerr;
}
```

18b *<impl.c 17b>+≡* <18a 18c>

```
NEOERR *cs_to_gstring(void *user, char *str)
{
    GString *out = user;

    g_string_append(out, str);
    return STATUS_OK;
}

NEOERR *tmpl_string(const char *tmpl, HDF *parms, GString *out, gboolean raw)
{
    return nerr_pass(tmpl_string_to(tmpl, parms, cs_to_gstring, out, raw));
}
```

18c *<impl.c 17b>+≡* <18b 19a>

```
NEOERR *cs_to_file(void *user, char *str)
{
    FILE *f = user;

    return fputs(str, f) < 0 ? nerr_raise_msg_errno("Writing") : STATUS_OK;
}

NEOERR *tmpl_string_to_file(const char *tmpl, HDF *parms, FILE *out,
                           gboolean raw)
{
    return nerr_pass(tmpl_string_to(tmpl, parms, cs_to_file, out, raw));
}
```

Template files are loaded from the default directory if relative.

18d *<Template Parameter Configuration 18d>≡*

```
# Default directory for templates (relative to $CONFIG_ROOT)
#tmpl_dir = tmpl
```

19a $\langle \text{tmpl.c 17b} \rangle + \equiv$ $\langle 18c \ 19c \rangle$

```
const char *tmpl_dir = "tmpl";
```

19b $\langle \text{Set up templates 19b} \rangle \equiv$

```
{
    extern const char *tmpl_dir;

    tmpl_dir = getconf("tmpl_dir", "tmpl");
    prepend_dir_if_relative(config_root, tmpl_dir);
    die_if_err(hdf_set_value(local_config, "hdf.loadpaths.tmpl_dir", tmpl_dir));
}
```

19c $\langle \text{tmpl.c 17b} \rangle + \equiv$ $\langle 19a \ 19d \rangle$

```
NEOERR *tmpl_file_to(const char *tmpl, HDF *parms, CSOUTFUNC outf,
                    void *outp, gboolean raw)
{
    CSPARSE *cs = NULL;
    NEOERR *nerr = STATUS_OK;

     $\langle \text{Set raw template parms 17d} \rangle$ 
    nerr_op(prepare_template(&cs, parms));
    if (nerr != STATUS_OK) {
         $\langle \text{Free raw template parms 17e} \rangle$  /* memory probs, so don't try to restore */
        return nerr_pass_ctx(nerr, "%s", tmpl);
    }
    nerr_op(cs_parse_file(cs, (char *)tmpl));
    nerr_op(cs_render(cs, outp, outf));
    cs_destroy(&cs);
     $\langle \text{Restore non-raw template parms 17f} \rangle$ 
    return nerr_pass_ctx(nerr, "%s", tmpl);
}
```

19d $\langle \text{tmpl.c 17b} \rangle + \equiv$ $\langle 19c \ 22b \rangle$

```
NEOERR *tmpl_file(const char *tmpl, HDF *parms, FILE *out, gboolean raw)
{
    return nerr_pass(tmpl_file_to(tmpl, parms, cs_to_file, out, raw));
}

NEOERR *tmpl_file_to_string(const char *tmpl, HDF *parms, GString *out,
                          gboolean raw)
{
    return nerr_pass(tmpl_file_to(tmpl, parms, cs_to_gstring, out, raw));
}
```

One problem with providing a macro library in ClearSilver is that the final newline of a file will appear in the final output. There is no extremely efficient way to deal with this, so a simple awk program is used.

19e $\langle (\text{build.nw}) \text{makefile.vars 2a} \rangle + \equiv$ $\langle 15c \ 20f \rangle$

```
CS_FILES=( $\langle \text{CS files 47a} \rangle$ )
```

19f $\langle (\text{build.nw}) \text{Build Source 10b} \rangle + \equiv$ $\langle 15f \rangle$

```
$ (CS_FILES) \
```

20a *<(build.nw) Clean built files 20a>≡*

```
rm -f $(CS_FILES)
```

20b *<(build.nw) makefile.rules 10c>+≡*

<16a 21>

```
# strip trailing \n - there has to be an easier way
$(CS_FILES) : $(NOWEB_ORDER)
    notangle -R$@ $^ | awk ' <Strip final newline 20c>' >$@
misc: $(CS_FILES)
```

20c *<Strip final newline 20c>≡*

(20b)

```
{ if(prline) print line; line = $$0; prline = 1 } END { ORS = ""; print line; }
```

Templates are provided in this document, but if a program does not use them, there is no point in installing them. For this reason, a chunk is created for the installation instructions which can be added to *<(build.nw) Install other files 11c>* if desired. Since HTML files are generally templates as well, they are also added in this rule.

20d *<Install ClearSilver templates 20d>≡*

20i>

```
mkdir -p $(DESTDIR)$(ETC_DIR)/tpl
cp -p $(CS_FILES) $(HTML_FILES) $(DESTDIR)$(ETC_DIR)/tpl
```

However, some HTML files may be just plain HTML that needs to be installed in the web server's document directory. For consistency, these are also copied into the template directory, but they are soft linked to the copy in the template directory. While the configuration option will always be visible, users can just ignore the option if there is no plain HTML.

20e *<(build.nw) makefile.config 7b>+≡*

<8b

```
# Install directory for plain HTML files
HTML_DIR=/var/www/html
```

20f *<(build.nw) makefile.vars 2a>+≡*

<19e 47d>

```
PLAIN_HTML=<Plain HTML 20h>
```

20g *<(build.nw) Plain Files 20g>≡*

```
<Plain HTML 20h>
```

20h *<Plain HTML 20h>≡*

(20)

```
\
```

20i *<Install ClearSilver templates 20d>+≡*

<20d

```
$(if $(PLAIN_HTML), \
mkdir -p $(DESTDIR)$(HTML_DIR); \
relup=; edir=$(ETC_DIR); hdir=$(HTML_DIR); \
edir=${edir%}/tpl/; hdir=${hdir%}/; \
while [ $${edir#$${hdir}} = $${edir}; do \
    relup=./$${relup}; \
```

```

20i <(Install ClearSilver templates 20d)>+≡
    hdir=${hdir%/*}/;/; \
done; \
ltarget=${relup}${edir#}/; \
for x in $(PLAIN_HTML); do \
    ln -sf ${ltarget}/${x} $(DESTDIR)$(HTML_DIR)/${x}; \
done)
<20d

```

A check rule is added for running `htmltidy` on plain HTML files, since they should be complete and error-free.

```

21 <(build.nw) makefile.rules 10c>+≡
ifneq ($(strip $(PLAIN_HTML)),)
check: checkhtml
checkhtml: $(PLAIN_HTML)
    for x in $(PLAIN_HTML); do \
        tidy -q -asxhtml -asxhtml -e ${x}; \
    done
endif
<20b 47e>

```

There are a number of common things a user might want to do in a template, that are either not supported by ClearSilver or are unnecessarily inefficient and ugly in ClearSilver. ClearSilver has a rudimentary mechanism for adding string functions to the template expression language. It also has a method for adding more general functions, but that method is currently marked as experimental and likely to change. This can probably be worked around using version detection, although the lack of convenient version macros in ClearSilver will probably require the use of external definitions. The version has remained at 0.10.5 for more than a year now, so this might not be an issue. String functions may only take one string as input ⁶, and produce one string as output. Any functions which do not fit into that pattern use the generic extension facility. Generic functions are also the only method that gives access to the HDF being used for variable substitutions. Even generic functions are limited, though, in that they can only take a fixed number of arguments.

The following functions are added to support the common transformations needed by templates:

parse_date(*formats*, *date*) Parse an absolute date in server's current locale using `strptime(3)` or a relative date using a custom format and return as seconds since UNIX epoch. The *formats* string consists of zero or more formats separated by vertical bars (`|`). The formats in the “Default formats for `parse_date`” table are appended to the given formats, in order (examples are for Friday, June 13, 2008, 18:07:10, with adjustments described below). The first format which matches the *date* will be used.

Since `strptime(3)` does not support time zones, the time zone is always the server's local time zone. This can be changed for subsequent formats by using the format `TZ=zone`. Note that the format of the *zone* string is operating system-dependent. See `tzset(3)` for details. If any of hours, minutes, or seconds are not present, they are set to zero. If the month is specified, but not the day, the first of the month is used. If only the year is specified, January 1 is used. These formats also support some relative times. If the year is unspecified, it is the current year, unless the day of year is specified, either by month or day of year, and that day is on or after today, in which case it is last year. If only the weekday is specified, then it is the last such weekday, excluding today. In the previous examples, the `%a` format only works between Saturday, June 14, and Friday, June 20, and the `%b` format only works between July 1, 2008, and June 30, 2009.

For specifically relative dates, the date must consist of a star (`*`), implying the current date, optionally followed by an offset. The offset is an optional sign (`+` or `-`; `-` is default), followed by an optional count (1 is the default), followed by an optional case-insensitive interval length indicator for seconds

⁶Care must be taken to ensure that the parameter really is a string. Once an expression becomes a number, concatenation becomes addition (even if one side cannot be converted to a number), and these string conversion functions become no-ops. The only way to convert an expression back into a string is to call the built-in string function `string.slice` with zero as the start and an extremely large end.

Format	Example
%Y-%m-%d %T	2008-06-13 18:07:10
%Y-%m-%d %R	2008-06-13 18:07
%Y-%m-%d	2008-06-13
%m/%d/%Y %T	6/13/2008 18:07:10
%m/%d/%Y %R	6/13/2008 18:07
%m/%d/%Y	6/13/2008
%d-%m-%Y %T	13-06-2008 18:07:10
%d-%m-%Y %R	13-06-2008 18:07
%d-%m-%Y	13-06-2008
%T	18:07:10
%R	18:07
%a %T	Friday 18:07:10
%a %R	Friday 18:07
%a	Friday
%b %Y	June 2008
%b	June
%c	Fri Jun 13 18:07:10 2008
%x	06/13/08

Table 1: Default formats for `parse_date`

(S), minutes ('), hours (H), days (D) (the default), months (M), or years (Y). For a valid offset, one or the other of the count or the interval length indicator must be present. All parts of the date finer than the specified interval are set to their lowest value. For example, if the interval is in months, then the day is set to the first of the month, and the time is set to midnight.

Finally, a blank input returns 0, always.

22a *<Initialize templates 22a>*≡ (18a) 26a>

```
nerr_op(cs_register_function(cs, (char *) "parse_date", 2, cs_parse_date));
```

22b *<tmpl.c 17b>*+≡ <19d 23d>

```
static const char const * date_fmts[] = {
    "%Y-%m-%d %T",
    "%Y-%m-%d %R",
    "%Y-%m-%d",
    "%m/%d/%Y %T",
    "%m/%d/%Y %R",
    "%m/%d/%Y",
    "%d-%m-%Y %T",
    "%d-%m-%Y %R",
    "%d-%m-%Y",
    "%T",
    "%R",
    "%a %T",
    "%a %R",
    "%a",
    "%b",
    "%b %Y",
    "%c",
    "%x %X",
    "%x",
    #if 0 /* these formats should just be specified in the argument instead */
    "%x %X",
    #endif
};
```

22b `<tpl.c 17b>+≡` `<19d 23d>`

```
    "%Ec",
    "%Ex",
    "%Ex %EX",
#endif
    NULL
};
```

23a `<(build.nw) Common C Includes 1>+≡` `(46a) <4c 27a>`

```
#include <pthread.h>
```

23b `<ClearSilver Support Globals 5b>+≡` `(5a) <15a 28a>`

```
/* Lock this if modifying timezone information */
extern pthread_mutex_t tz_lock;
```

23c `<cs_supt.c 5e>+≡` `<14b 28c>`

```
/* cheat: if it's already defined elsewhere, disable */
#ifndef TZ_LOCK_DEFINED
pthread_mutex_t tz_lock = PTHREAD_MUTEX_INITIALIZER;
#endif
```

23d `<tpl.c 17b>+≡` `<22b 25>`

```
time_t parse_date(char *formats, const char *date_str)
{
    char *s, *e = NULL;
    const char *fmt, **fmtp;
    struct tm tm_parsed, tm_ref, tm_now;
    time_t t;
    const char *old_tz = NULL; /* init to shut gcc up */
    gboolean set_tz = FALSE;
    gboolean got_err = FALSE;

    if(!date_str || !*date_str)
        return 0;
    memset(&tm_ref, 0xff, sizeof(tm_ref));
    t = time(NULL);
    localtime_r(&t, &tm_now);
    if(formats && *formats) {
        fmt = formats;
        while(1) {
            s = strchr(fmt, '|');
            if(s)
                *s++ = 0;
            if(!strncmp(fmt, "TZ=", 3)) {
                if(!set_tz) {
                    pthread_mutex_lock(&tz_lock);
                    old_tz = getenv("TZ");
                    set_tz = TRUE;
                }
                setenv("TZ", fmt + 3, 1);
                tzset();
            } else {
                tm_parsed = tm_ref;
                if((e = strptime(date_str, fmt, &tm_parsed)) && !*e)
                    break;
            }
            if(s)
                fmt = s;
            else
                break;
        }
    }
    if(s)
        fmt = s;
    else
```

23d

<tmpl.c 17b>+≡

<22b 25>

```

        break;
    }
}
for (fmt = date_fmts; (!e || *e) && *fmt; fmt++) {
    tm_parsed = tm_ref;
    e = strptime(date_str, *fmt, &tm_parsed);
}
if (!e || *e) {
    if (*date_str == '*') {
        gboolean add = TRUE;
        tm_parsed = tm_now;
        gint num_add = 1;

        if (++date_str == '+')
            date_str++;
        else if (*date_str == '-') {
            date_str++;
            add = FALSE;
        }
        if (isdigit(*date_str)) {
            num_add = atoi(date_str);
            while (isdigit(++date_str));
        }
        if (!add)
            num_add = -num_add;
        if (*date_str && date_str[1])
            got_err = TRUE; /* parse error */
    } else
        switch (toupper(*date_str)) {
            case 'S':
                tm_parsed.tm_sec += num_add;
                break;
            case '\':
                tm_parsed.tm_min += num_add;
                break;
            case 'H':
                tm_parsed.tm_hour += num_add;
                break;
            case 'D':
            case 0:
                tm_parsed.tm_mday += num_add;
                break;
            case 'M':
                tm_parsed.tm_mon += num_add;
                break;
            case 'Y':
                tm_parsed.tm_year += num_add;
                break;
            default:
                got_err = TRUE; /* parse error */
        }
}
if (!got_err)
    /* all cases in following switch fall through */
    switch (toupper(*date_str)) {
        case 'Y':
            tm_parsed.tm_mon = 0;
        case 'M':
            tm_parsed.tm_mday = 1;
        case 'D':
        case 0:
            tm_parsed.tm_hour = 0;
        case 'H':
            tm_parsed.tm_min = 0;
        case '\':

```


23d <tmpl.c 17b>+≡

<22b 25>

```

        tm_parsed.tm_sec = 0;
        case 'S':
            break;
    }
} else
    got_err = TRUE; /* unknown */
} else {
    /* adjust for partial specification; bias for the past */
    if (tm_parsed.tm_sec == tm_ref.tm_sec)
        tm_parsed.tm_sec = 0;
    if (tm_parsed.tm_min == tm_ref.tm_min)
        tm_parsed.tm_min = 0;
    if (tm_parsed.tm_hour == tm_ref.tm_hour)
        tm_parsed.tm_hour = 0;
    tm_parsed.tm_isdst = -1;
    if (tm_parsed.tm_year == tm_ref.tm_year) {
        tm_parsed.tm_year = tm_now.tm_year;
        if (tm_parsed.tm_mon != tm_ref.tm_mon) {
            if (tm_parsed.tm_mon > tm_now.tm_mon)
                tm_parsed.tm_year--;
            else if (tm_parsed.tm_mon == tm_now.tm_mon &&
                     (tm_parsed.tm_mday == tm_ref.tm_mday ||
                      tm_parsed.tm_mday > tm_now.tm_mday))
                tm_parsed.tm_year--;
        } else if (tm_parsed.tm_yday != tm_ref.tm_yday) {
            if (tm_parsed.tm_yday > tm_now.tm_yday)
                tm_parsed.tm_year--;
            tm_parsed.tm_mon = 0;
            tm_parsed.tm_mday = tm_parsed.tm_yday;
        }
    }
    if (tm_parsed.tm_mday == tm_ref.tm_mday) {
        if (tm_parsed.tm_yday != tm_ref.tm_yday) {
            tm_parsed.tm_mday = tm_parsed.tm_yday;
            tm_parsed.tm_mon = 0;
        } else if (tm_parsed.tm_wday != tm_ref.tm_wday) {
            if (tm_parsed.tm_wday >= tm_now.tm_wday)
                tm_parsed.tm_wday -= 7;
            tm_parsed.tm_mday = tm_now.tm_mday;
            tm_parsed.tm_mday -= tm_now.tm_wday - tm_parsed.tm_wday;
        } else if (tm_parsed.tm_mon != tm_ref.tm_mon)
            tm_parsed.tm_mday = 1;
        else
            tm_parsed.tm_mday = tm_now.tm_mday;
    }
    if (tm_parsed.tm_mon == tm_ref.tm_mon)
        tm_parsed.tm_mon = tm_now.tm_mon;
}
t = mktime(&tm_parsed);
if (set_tz) {
    if (old_tz)
        setenv("TZ", old_tz, 1);
    else
        unsetenv("TZ");
    tzset();
    pthread_mutex_unlock(&tz_lock);
}
if (got_err)
    return 0;
else
    return t;
}

```

25 <23d 26b>

<impl.c 17b>+≡

```
NEOERR *cs_parse_date(CSPARSE *cs, CS_FUNCTION *csf, CSARG *args, CSARG *result)
{
    NEOERR *nerr = STATUS_OK;
    char *formats = NULL, *date_str = NULL;
    result->op_type = CS_TYPE_NUM;
    result->s = NULL;
    nerr = cs_arg_parse(cs, args, "ss", &formats, &date_str);
    if(nerr == STATUS_OK)
        /* n is long, so this will fail in 2038 on 32-bit systems */
        result->n = parse_date(formats, date_str);
    if(formats)
        free(formats);
    if(date_str)
        free(date_str);
    return nerr;
}
```

format_date(format, timestamp) Format date using `strftime(3)`, with optional *format*. A blank *format* is replaced by `%c`. The *timestamp* is seconds since UNIX epoch.

26a (18a) <22a 27b>

<Initialize templates 22a>+≡

```
nerr_op(cs_register_function(cs, (char *) "format_date", 2, cs_format_date));
```

26b <25 27c>

<impl.c 17b>+≡

```
NEOERR *cs_format_date(CSPARSE *cs, CS_FUNCTION *csf, CSARG *args, CSARG *result)
{
    char *buf;
    quint buflen, ret;
    long t_arg;
    time_t t;
    char *fmt_arg = NULL;
    const char *fmt;
    struct tm tm_in;
    NEOERR *nerr;

    nerr = cs_arg_parse(cs, args, "si", &fmt_arg, &t_arg);
    if(nerr != STATUS_OK) {
        if(fmt_arg)
            free(fmt_arg);
        return nerr;
    }
    fmt = fmt_arg;
    /* 32-bit systems will fail in 2038 due to use of long */
    t = t_arg;
    if(!fmt || !*fmt)
        fmt = "%c";
    localtime_r(&t, &tm_in);
    buflen = strlen(fmt) * 4;
    buf = malloc(buflen);
    while(buf) {
        ret = strftime(buf, buflen, fmt, &tm_in);
        if(ret && ret < buflen)
            break;
        buflen *= 2;
        if(buflen >= 1024) {
            free(buf);
            buf = NULL;
        } else {
            char *tmp = realloc(buf, buflen);

```

26b `<impl.c 17b>+≡` `<25 27c>`

```

    if (!tmp)
        free(buf);
    buf = tmp;
}
result->op_type = CS_TYPE_STRING;
result->n = 0;
result->s = buf;
result->alloc = 1;
free(fmt_arg);
if (!buf)
    return nerr_raise_msg_errno("No memory for conversion");
return STATUS_OK;
}

```

url_unescape(*string*) URL-decode *string* (URL-encoding is provided by the CGI library as `url_escape(string)`)

27a `<(build.nw) Common C Includes 1>+≡` (46a) `<23a 38d>`

```
#include <cgi/cgi.h>
```

27b `<Initialize templates 22a>+≡` (18a) `<26a 31a>`

```

if (nerr == STATUS_OK) {
    nerr = cgi_register_strfuncs(cs);
    nerr_ignore(&nerr);
}
nerr_op(cs_register_strfunc(cs, (char *) "url_unescape", cs_url_unescape));

```

27c `<impl.c 17b>+≡` `<26b 31b>`

```

NEOERR *cs_url_unescape(const char *in, char **out)
{
    *out = strdup(in);
    if (!*out)
        return nerr_raise_msg("No memory for conversion");
    cgi_url_unescape(*out);
    return STATUS_OK;
}

```

json_escape(*variable-name*) Escape *variable* and its children using JavaScript Object Notation (JSON). See <http://www.json.org> for the complete format specification. Nonexistent variables and variables without values or children are output as `null`. Variables with values are output as strings by default, but may be output as numbers by adding the `num` attribute, and may be output as booleans by adding the `bool` attribute; booleans with no value, blank values, or the value `0` are output as `false`. Variables with children are output as objects by default, but may be output as arrays (i.e., children names are sorted, but not output) by adding the `array` attribute; arrays with no value are output as an empty array, but there is no way to output an empty object (`{}`). String values must be UTF-8 encoded. If any variables have raw values which may conflict with UTF-8, they should be double-encoded using e.g. URL-encoding to ensure that their value is converted to ASCII first.

It would be nice to be able to pass in the variable rather than passing in the variable's name, but the ClearSilver function support only supports integer and string variables, and not object references. JSON encoding is not supported by any functions in the libraries being used, so a generic `GString` version is provided as well.

First, in order to support the different data types with indistinguishable internal representations, flags can be set on variables using HDF attributes. These attributes can be set using the API or within an HDF using the bracketed attribute name immediately after the variable name. There is no way to set attributes within templates, so some sort of skeleton HDF file would need to be read in and used for that.

28a *<ClearSilver Support Globals 5b>+≡* (5a) <23b

```
typedef enum json_var_type {
    JSON_UNK, JSON_ARRAY, JSON_BOOL, JSON_NUM
} json_var_type;
```

28b *<(build.nw) Known Data Types 2g>+≡* <15b 58>

```
json_var_type, %
```

28c *<cs_supt.c 5e>+≡* <23c 28d>

```
json_var_type hdf_json_var_type(HDF *obj)
{
    HDF_ATTR *attrs = hdf_obj_attr(obj);

    while(attrs) {
        if(!strcmp(attrs->key, "num"))
            return JSON_NUM;
        else if(!strcmp(attrs->key, "bool"))
            return JSON_BOOL;
        else if(!strcmp(attrs->key, "array"))
            return JSON_ARRAY;
        attrs = attrs->next;
    }
    return JSON_UNK;
}
```

The conversion function recursively appends values to a string. If the top level has children, either an object (attribute-value pairs, which include the name of each child) or an array (values only; the names are just sorted before display) is appended.

28d *<cs_supt.c 5e>+≡* <28c 30b>

```
GString *g_string_append_json(GString *buf, HDF *hdf)
{
    json_var_type vt = hdf_json_var_type(hdf);

    if(hdf_obj_child(hdf)) {
        if(vt == JSON_ARRAY) {
            char c = '[';
            hdf_sort_obj(hdf, comp_hdf_name);
            for(hdf = hdf_obj_child(hdf); hdf; hdf = hdf_obj_next(hdf)) {
                g_string_append_c(buf, c);
                c = ',';
                g_string_append_json(buf, hdf);
            }
            g_string_append_c(buf, ']');
        } else {
            char c = '{';
            for(hdf = hdf_obj_child(hdf); hdf; hdf = hdf_obj_next(hdf)) {
                g_string_append_c(buf, c);
                c = ',';
                append_unicode_quoted(buf, hdf_obj_name(hdf));
                g_string_append_c(buf, ':');
                g_string_append_json(buf, hdf);
            }
        }
    }
}
```

28d $\langle cs_supt.c\ 5e \rangle + \equiv$ $\langle 28c\ 30b \rangle$

```

    g_string_append_c(buf, '}');
}
return buf;
}
Append JSON-encoded hdf value to buf 29a
return buf;
}

```

If there are no children, the value is appended. Technically, a NULL value could indicate either an empty object, an empty array, a boolean false, or null. If the array flag is set, an empty array is appended. If the boolean flag is set, a boolean false is appended. There is no way to distinguish empty objects and null, so null is appended.

29a $\langle Append\ JSON\text{-}encoded\ hdf\ value\ to\ buf\ 29a \rangle \equiv$ (28d) 29b

```

const char *s = hdf_obj_value(hdf);

if(!s) {
    if(vt == JSON_BOOL)
        g_string_append(buf, "false");
    else if(vt == JSON_ARRAY)
        g_string_append(buf, "[]");
    else
        g_string_append(buf, "null");
    return buf;
}

```

For ClearSilver booleans, empty strings and zero are false. Technically, if the zero is considered a string, it is not false, but there is no way to easily distinguish. There is also no real need to check for other forms of zero, such as hexadecimal zero or multiple zero digits.

29b $\langle Append\ JSON\text{-}encoded\ hdf\ value\ to\ buf\ 29a \rangle + \equiv$ (28d) $\langle 29a\ 29c \rangle$

```

if(vt == JSON_BOOL) {
    if(!*s || !strcmp(s, "0"))
        g_string_append(buf, "false");
    else
        g_string_append(buf, "true");
    return buf;
}

```

Numbers are only appended as numbers if they are really valid numbers. JSON does not support octal or hexadecimal numbers, but this code does, and converts it to decimal before printing. If it is not a valid number, it falls through to string formatting.

29c $\langle Append\ JSON\text{-}encoded\ hdf\ value\ to\ buf\ 29a \rangle + \equiv$ (28d) $\langle 29b\ 30a \rangle$

```

if(vt == JSON_NUM && (*s == '-' || isdigit(*s))) {
    const char *d = *s == '-' ? s + 1 : s;
    if((*d >= '1' && *d <= '9') || (*d == '0' && (!d[1] || d[1] == '.'))) {
        while(isdigit(++d));
        if(*d == '.' && isdigit(d[1])) {
            while(isdigit(++d));
            if(*d == 'e' || *d == 'E') {
                if(d[1] == '+' || d[1] == '-')
                    d++;
                if(isdigit(d[1]))
                    while(isdigit(++d));
            }
        }
    }
}

```

29c *<Append JSON-encoded hdf value to buf 29a>+≡* (28d) *<29b 30a>*

```

    if(!*d) {
        g_string_append(buf, s);
        return buf;
    }
    else if(*d == '0') {
        char *e;
        unsigned long long v = strtoull(s, &e, 0);

        if(!*e) {
            g_string_append_printf(buf, "%lld", v);
            return buf;
        }
    }
}

```

Strings are only complicated in that they must be UTF-8 encoded. It is assumed that they already are; in most cases, this means that the string must be ASCII to begin with. As a fallback, if the string fails UTF-8 validation, it is printed as ASCII with special characters escaped as though they were unicode.

30a *<Append JSON-encoded hdf value to buf 29a>+≡* (28d) *<29c*
append_unicode_quoted(buf, s);

30b *<cs_supt.c 5e>+≡* *<28d 31c>*

```

GString *append_unicode_quoted(GString *buf, const char *s)
{
    g_string_append_c(buf, '"');
    if(g_utf8_validate(s, -1, NULL))
        while(*s) {
            gunichar uc = g_utf8_get_char(s);
            s = g_utf8_next_char(s);
            <Tack escaped uc to buf 30c>
        }
    else
        while(*s) {
            unsigned char uc = *s++;
            <Tack escaped uc to buf 30c>
        }
    g_string_append_c(buf, '"');
    return buf;
}

```

30c *<Tack escaped uc to buf 30c>≡* (30b)

```

if(uc < 128 && isprint(uc) && uc != '"' && uc != '\\')
    g_string_append_c(buf, uc);
else switch(uc) {
    case '\b':
        g_string_append(buf, "\\b");
        break;
    case '\t':
        g_string_append(buf, "\\t");
        break;
    case '\f':
        g_string_append(buf, "\\f");
        break;
    case '\n':
        g_string_append(buf, "\\n");
        break;
    case '\r':
        g_string_append(buf, "\\r");

```

30c \langle Tack escaped uc to buf 30c $\rangle \equiv$ (30b)

```

    break;
case '\\':
case '"':
case '/':
    g_string_append_c(buf, '\\');
    g_string_append_c(buf, uc);
    break;
default:
    g_string_append_printf(buf, "\\u%04x", uc);
    break;
}

```

Finally, the template function is pretty simple, except that it needs to be a full callback in order to access the HDF.

31a \langle Initialize templates 22a $\rangle + \equiv$ (18a) \langle 27b 36a \rangle

```
nerr_op(cs_register_function(cs, (char *) "json_escape", 1, cs_json_escape));
```

31b \langle impl.c 17b $\rangle + \equiv$ \langle 27c 36b \rangle

```

NEOERR *cs_json_escape(CSPARSE *cs, CS_FUNCTION *csf, CSARG *args, CSARG *result)
{
    NEOERR *nerr = STATUS_OK;
    HDF *src;
    char *varname;
    GString *json;

    nerr = cs_arg_parse(cs, args, "s", &varname);
    result->op_type = CS_TYPE_STRING;
    if(nerr == STATUS_OK) {
        json = g_string_new("");
        src = hdf_get_obj(cs->hdf, varname);
        if(src)
            g_string_append_json(json, src);
        else
            g_string_assign(json, "null");
        result->s = g_string_free(json, FALSE);
    } else
        result->s = NULL;
    if(varname)
        free(varname);
    return nerr;
}

```

json_unescape(variable-name, value) Set *variable* to the result of parsing *value* using JavaScript Object Notation (JSON). See <http://www.json.org> for the complete format specification. Arrays will have their `array` attribute set and their children will receive numeric sequence names. Booleans will be set to 1 for `true` and blank for `false` and have their `bool` attribute set. Numbers will have their `num` attribute set. Unicode escapes in the string will be encoded as per UTF-8.

Reading JSON is probably not something C (or template) code will ever do, but nonetheless, here is the reverse operation. Just in case the string has more than one value encoded, an end pointer is provided. This is actually used in recursive calls, since the value is embedded in a structure. Reading from a JSON file might be useful as well, but it requires a character of lookahead, and is probably not useful enough to require a separate function in order to allow reading in large volumes of data.

31c <30b 35c>

```

<cs_supt.c 5e>+≡
NEOERR *json_from_string(const char *s, HDF *hdf)
{
    NEOERR *nerr = nerr_pass(embedded_json_from_string(s, hdf, &s));
    if (nerr == STATUS_OK) {
        while (isspace(*s))
            s++;
        if (*s)
            return nerr_raise_msg("Invalid JSON: Garbage after value");
    }
    return nerr;
}

NEOERR *embedded_json_from_string(const char *s, HDF *hdf, const char **ep)
{
    NEOERR *nerr = STATUS_OK;
    <Convert JSON to HDF 32a>
    return nerr;
}

```

Any JSON value may have leading or trailing space.

32a (31c) 32b>

```

<Convert JSON to HDF 32a>≡
while (isspace(*s))
    s++;
if (!*s)
    return nerr_raise_msg("Invalid JSON: Expected value");

```

Objects start with curly braces. A recursive call is used to parse values. Names could be processed by doing a recursive call with a dummy HDF object as its target, but instead the string processing is done in a separate function.

32b (31c) <32a 33a>

```

<Convert JSON to HDF 32a>+≡
if (*s == '{') {
    gboolean gotone = FALSE;
    HDF *cn;
    GString *buf = NULL;

    s++;
    while (nerr == STATUS_OK) {
        while (isspace(*s))
            s++;
        if (*s == '}')
            break;
        if (gotone) {
            if (*s != ',') {
                nerr = nerr_raise_msg("Invalid JSON: expected , or }");
                break;
            }
            while (isspace(++s));
        }
        if (*s != '"') {
            nerr = nerr_raise_msg("Invalid JSON: expected quoted name");
            break;
        }
        gotone = TRUE;
        if (!buf)
            buf = g_string_new("");
        else
            g_string_truncate(buf, 0);
        nerr = parse_json_string(s, buf, &s);
    }
}

```


32b <Convert JSON to HDF 32a>+≡ (31c) <32a 33a>

```

    if(nerr == STATUS_OK) {
        while(isspace(*s))
            s++;
        if(*s != ':' ) {
            nerr = nerr_raise_msg("Invalid JSON: expected :");
            break;
        }
        s++;
    }
    nerr_op(hdf_get_node(hdf, buf->str, &cn));
    nerr_op(embedded_json_from_string(s, cn, &s));
}
if(buf)
    g_string_free(buf, TRUE);
if(ep && nerr == STATUS_OK)
    *ep = s + 1;
return nerr;
}

```

Arrays start with square brackets. A recursive call is used to parse values, and names are just sequential numbers. Even though the function is intended to be called with an empty object, an attempt is made to avoid any existing children. This means that if values are not intended to be merged, they should first be destroyed.

33a <Convert JSON to HDF 32a>+≡ (31c) <32b 33b>

```

if(*s == '[') {
    gboolean gotone = FALSE;
    int idx = -1;
    char idx_buf[22];
    HDF *cn;

    s++;
    for(cn = hdf_obj_child(hdf); cn; cn = hdf_obj_next(cn)) {
        int cn_idx = atoi(hdf_obj_name(cn));
        if(cn_idx >= idx)
            idx = cn_idx;
    }
    hdf_set_attr(hdf, NULL, "array", "1");
    while(nerr == STATUS_OK) {
        while(isspace(*s))
            s++;
        if(*s == ']')
            break;
        if(gotone) {
            if(*s != ',' ) {
                nerr = nerr_raise_msg("Invalid JSON: expected , or ]");
                break;
            }
            while(isspace(++s));
        }
        gotone = TRUE;
        sprintf(idx_buf, "%d", ++idx);
        nerr = hdf_get_node(hdf, idx_buf, &cn);
        nerr_op(embedded_json_from_string(s, cn, &s));
    }
    if(ep && nerr == STATUS_OK)
        *ep = s + 1;
    return nerr;
}

```

Boolean values are unquoted literals.

33b <Convert JSON to HDF 32a>+≡ (31c) <33a 34a>

```
#define is_end(c) (!(c) || isspace(c) || (c) == ',' || (c) == ']' || (c) == '}')
if(!strcmp(s, "true", 4) && is_end(s[4])) {
    nerr = hdf_set_attr(hdf, NULL, "bool", "1");
    nerr_op(hdf_set_value(hdf, NULL, "1"));
    if(ep)
        *ep = s + 4;
    return nerr;
}
if(!strcmp(s, "false", 5) && is_end(s[5])) {
    nerr = hdf_set_attr(hdf, NULL, "bool", "1");
    nerr_op(hdf_set_value(hdf, NULL, "0"));
    if(ep)
        *ep = s + 5;
    return nerr;
}
```

An NULL value should probably clear out the entire value, if it already exists. Instead, it is simply ignored, on the assumption that the value is already NULL.

34a <Convert JSON to HDF 32a>+≡ (31c) <33b 34b>

```
if(!strcmp(s, "null", 4) && is_end(s[4])) {
    if(ep)
        *ep = s + 4;
    return STATUS_OK;
}
```

Numbers can be parsed using `strtoul` or `strtod`, but their format needs to be validated first. Since all HDF values are basically strings, there is no need to really parse the number. For floating point values, precision would be lost by such an action, anyway. JSON also provides no range for valid values, so it is possible to have numbers outside of the range for even `strtoull`.

34b <Convert JSON to HDF 32a>+≡ (31c) <34a 35a>

```
if(isdigit(*s) || (*s == '-' && isdigit(s[1]))) {
    const char *e = *s == '-' ? s + 1 : s;
    gboolean is_float;

    if(*e == '0' && isdigit(e[1])) /* octal; explicitly forbidden */
        return nerr_raise_msg("Invalid JSON: octal numbers not allowed");
    while(isdigit(++e));
    is_float = *e == '.';
    if(is_float && isdigit(e[1])) {
        while(isdigit(++e));
        if(*e == 'e' || *e == 'E') {
            if((e[1] == '+' || e[1] == '-') && isdigit(e[2]))
                ++e;
            if(!isdigit(e[1]))
                return nerr_raise_msg("Invalid JSON: invalid exponent");
            while(isdigit(++e));
        }
    }
    if(!is_end(*e))
        return nerr_raise_msg("Invalid JSON: invalid numeric format");
    GString *buf = g_string_new_len(s, (int)(e - s));
    if(ep)
        *ep = e;
    nerr = hdf_set_attr(hdf, NULL, "num", "1");
    return hdf_set_buf(hdf, NULL, g_string_free(buf, FALSE));
}
```

Finally, as mentioned above, strings get their own processing routine. This makes the parser portion pretty simple.

35a $\langle \text{Convert JSON to HDF 32a} \rangle + \equiv$ (31c) $\langle 34b \ 35b \rangle$

```
if(*s == '"') {
    GString *buf = g_string_new("");
    nerr = parse_json_string(s, buf, ep);
    nerr_op(hdf_set_buf(hdf, NULL, g_string_free(buf, FALSE)));
    return nerr;
}
```

That covers all possible value formats.

35b $\langle \text{Convert JSON to HDF 32a} \rangle + \equiv$ (31c) $\langle 35a \rangle$

```
return nerr_raise_msg("Invalid JSON: unrecognized value format");
```

35c $\langle \text{cs_supt.c 5e} \rangle + \equiv$ $\langle 31c \ 40a \rangle$

```
NEOERR *parse_json_string(const char *s, GString *buf, const char **ep)
{
    if(*s != '"')
        return nerr_raise_msg("Invalid JSON: expected '\"');
    for(s++; *s && *s != '"'; s++) {
        if(*s != '\\') {
            g_string_append_c(buf, *s);
            continue;
        }
        switch(++s) {
            case '"':
            case '\\':
            case '/':
                g_string_append_c(buf, *s);
                break;
            case 'b':
                g_string_append_c(buf, '\b');
                break;
            case 'f':
                g_string_append_c(buf, '\f');
                break;
            case 'n':
                g_string_append_c(buf, '\n');
                break;
            case 'r':
                g_string_append_c(buf, '\r');
                break;
            case 't':
                g_string_append_c(buf, '\t');
                break;
            case 'u':
                if(!isxdigit(++s) || !isxdigit(++s) || !isxdigit(++s) ||
                   !isxdigit(++s))
                    return nerr_raise_msg("Invalid JSON");
                char unibuf[6];
                int len, c;

                sscanf(s - 4, "%04x", &c);
                len = g_unichar_to_utf8(c, unibuf);
                g_string_append_len(buf, unibuf, len);
                break;
            default:
                return nerr_raise_msg("Invalid JSON: invalid string format");
        }
    }
}
```

35c <cs_supt.c 5e>+≡ <31c 40a>

```

    }
    if (*s == '"')
        s++;
    else
        return nerr_raise_msg("Invalid JSON: no terminating \" on string");
    if (ep)
        *ep = s;
    return STATUS_OK;
}

```

36a <Initialize templates 22a>+≡ (18a) <31a 36c>

```
nerr_op(cs_register_function(cs, (char *) "json_unescape", 2, cs_json_unescape));
```

36b <impl.c 17b>+≡ <31b 36d>

```

NEOERR *cs_json_unescape(CSPARSE *cs, CS_FUNCTION *csf, CSARG *args,
                          CSARG *result)
{
    NEOERR *nerr = STATUS_OK;
    HDF *target;
    char *varname, *val;

    nerr = cs_arg_parse(cs, args, "ss", &varname, &val);
    nerr_op(hdf_get_node(cs->hdf, varname, &target));
    nerr_op(json_from_string(val, target));
    /* no void functions, so return 1 on success (i.e., always) */
    result->op_type = CS_TYPE_NUM;
    result->s = NULL;
    result->n = nerr == STATUS_OK;
    if (varname)
        free(varname);
    if (val)
        free(val);
    return nerr;
}

```

to_hex(bin) Convert a URL-encoded binary blob to a string of lower-case hexadecimal digits. This is mostly for displaying checksums. The blob must be URL-encoded so that zeroes are handled properly in the string.

36c <Initialize templates 22a>+≡ (18a) <36a 37a>

```
nerr_op(cs_register_strfunc(cs, (char *) "to_hex", cs_to_hex));
```

36d <impl.c 17b>+≡ <36b 37b>

```

NEOERR *cs_to_hex(const char *in, char **out)
{
    quint8 c, *op;

    *out = malloc(strlen(in) * 2 + 1);
    if (!*out)
        return nerr_raise_msg("No memory for conversion");
    op = (quint8 *)*out;
    while(*in) {
        if (*in == '%' && isxdigit(in[1]) && isxdigit(in[2])) {
            c = *++in & 0xf;
            if (*in > '9')
                c += 10 - ('a' & 0xf);

```

36d `<tmpl.c 17b>+≡` `<36b 37b>`

```

    c <= 4;
    c += *++in & 0xf;
    if(*in > '9')
        c += 10 - ('a' & 0xf);
    } else if(*in == '+')
        c = ' ';
    else
        c = *in;
    *op = (c >> 4) + '0';
    if(c > 0x9f)
        *op += 'a' - '0' - 10;
    *++op = (c & 0xf) + '0';
    if(c > 9)
        *op += 'a' - '0' - 10;
    op++;
    in++;
}
*op = 0;
return STATUS_OK;
}

```

from_hex(hex) Convert a string of hexadecimal digits to a URL-encoded binary blob. This is mostly for converting checksums from their usual format to that expected by these utilities. The return must be URL-encoded to prevent issues with zeroes in string returns.

37a `<Initialize templates 22a>+≡` (18a) `<36c 37c>`

```
nerr_op(cs_register_strfunc(cs, (char *) "from_hex", cs_from_hex));
```

37b `<tmpl.c 17b>+≡` `<36d 37d>`

```

NEOERR *cs_from_hex(const char *in, char **out)
{
    char *op;

    *out = op = malloc(strlen(in) * 3 / 2 + 1);
    if(!*out)
        return nerr_raise_msg("No memory for conversion");
    while(isxdigit(*in) && isxdigit(in[1])) {
        *op++ = '%';
        *op++ = toupper(*in++);
        *op++ = toupper(*in++);
    }
    if(*in)
        return nerr_raise_msg("Invalid hex string");
    *op = 0;
    return STATUS_OK;
}

```

to_lower(string) Convert *string* to lower-case in the server's current locale. This is done a byte at a time using the `ctype.h` function. This means that the string will probably be mangled in UTF-8 locales or if the input locale does not match the server's locale.

37c `<Initialize templates 22a>+≡` (18a) `<37a 38a>`

```
nerr_op(cs_register_strfunc(cs, (char *) "to_lower", cs_to_lower));
```

37d `<impl.c 17b>+≡` `<37b 38b>`

```

NEOERR *cs_to_lower(const char *in, char **out)
{
    char *op;

    *out = op = malloc(strlen(in) + 1);
    if(!*out)
        return nerr_raise_msg("No memory for conversion");
    while(*in)
        *op++ = tolower(*in++);
    *op = 0;
    return STATUS_OK;
}

```

to_upper(string) Convert *string* to upper-case. The comments for `to_lower()` apply here as well.

38a `<Initialize templates 22a>+≡` `(18a) <37c 38c>`

```

nerr_op(cs_register_strfunc(cs, (char *) "to_upper", cs_to_upper));

```

38b `<impl.c 17b>+≡` `<37d 38e>`

```

NEOERR *cs_to_upper(const char *in, char **out)
{
    char *op;

    *out = op = malloc(strlen(in) + 1);
    if(!*out)
        return nerr_raise_msg("No memory for conversion");
    while(*in)
        *op++ = toupper(*in++);
    *op = 0;
    return STATUS_OK;
}

```

pw_uid(id) Return the password file entry for the given user ID on the local system. Since this uses the system function, it may not be a real file entry, but it is returned in the format of one.

38c `<Initialize templates 22a>+≡` `(18a) <38a 39b>`

```

nerr_op(cs_register_function(cs, (char *) "pw_uid", 1, cs_pw_uid));

```

38d `<(build.nw) Common C Includes 1>+≡` `(46a) <27a 39e>`

```

#include <pwd.h>

```

38e `<impl.c 17b>+≡` `<38b 39c>`

```

/* not reentrant, but not for threaded programs */
NEOERR *cs_pw_uid(CSPARSE *cs, CS_FUNCTION *csf, CSARG *args, CSARG *result)
{
    long uid;
    NEOERR *nerr = cs_arg_parse(cs, args, "i", &uid);
    if(nerr != STATUS_OK)
        return nerr;
    result->op_type = CS_TYPE_STRING;
    result->n = 0;
    char *s;

```

38e $\langle impl.c\ 17b \rangle + \equiv$ $\langle 38b\ 39c \rangle$

```

struct passwd *pw = getpwuid((uid_t)uid);
 $\langle Set\ s\ to\ passwd\ file\ entry\ 39a \rangle$ 
result->s = s;
result->alloc = 1;
return STATUS_OK;
}

```

39a $\langle Set\ s\ to\ passwd\ file\ entry\ 39a \rangle \equiv$ (38e 39c)

```

GString *res;

if(!pw)
    return nerr_raise_msg_errno("unknown user");
res = g_string_new("");
g_string_printf(res, "%s:.*%ld:%ld:%s:%s:%s",
                pw->pw_name, /* pw->pw_passwd, */ (long)pw->pw_uid,
                (long)pw->pw_gid, pw->pw_gecos, pw->pw_dir, pw->pw_shell);
s = g_string_free(res, FALSE);

```

pw_nam(name) Return the password file entry for the given user name on the local system. Since this uses the system function, it may not be a real file entry, but it is returned in the format of one.

39b $\langle Initialize\ templates\ 22a \rangle + \equiv$ (18a) $\langle 38c\ 39d \rangle$

```

nerr_op(cs_register_strfunc(cs, (char *)"pw_nam", cs_pw_nam));

```

39c $\langle impl.c\ 17b \rangle + \equiv$ $\langle 38e\ 39f \rangle$

```

NEOERR *cs_pw_nam(const char *in, char **out)
{
    struct passwd *pw = getpwnam(in);
    char *s;
     $\langle Set\ s\ to\ passwd\ file\ entry\ 39a \rangle$ 
    *out = s;
    return STATUS_OK;
}

```

re_match(re, string) Return integer flag 1 if URL-encoded POSIX extended regular expression *re* matches (non-URL-encoded) *string*.

39d $\langle Initialize\ templates\ 22a \rangle + \equiv$ (18a) $\langle 39b\ 40b \rangle$

```

nerr_op(cs_register_function(cs, (char *)"re_match", 2, cs_re_match));

```

39e $\langle (build.nw)\ Common\ C\ Includes\ 1 \rangle + \equiv$ (46a) $\langle 38d \rangle$

```

#include <regex.h>

```

39f $\langle impl.c\ 17b \rangle + \equiv$ $\langle 39c\ 41 \rangle$

```

NEOERR *cs_re_match(CSPARSE *cs, CS_FUNCTION *csf, CSARG *args, CSARG *result)
{
    regex_t re;
    int ret;
    char *in = NULL, *re_s = NULL;
    NEOERR *nerr;

```

39f <39c 41>

```

<impl.c 17b>+≡
nerr = cs_arg_parse(cs, args, "ss", &re_s, &in);
if(nerr != STATUS_OK) {
    if(in)
        free(in);
    if(re_s)
        free(re_s);
    return nerr;
}
cgi_url_unescape(re_s);
ret = regcomp(&re, re_s, REG_EXTENDED | REG_NOSUB);
if(ret) {
    nerr = nerr_pass(regerr_nerr(re_s, &re, ret));
    free(re_s);
    free(in);
    return nerr;
}
free(re_s);
result->s = NULL;
result->op_type = CS_TYPE_NUM;
result->n = !regexec(&re, in, 0, NULL, 0);
regfree(&re);
free(in);
return STATUS_OK;
}

```

40a <35c 46b>

```

<cs_supt.c 5e>+≡
NEOERR *regerr_nerr(const char *prefix, regex_t *re, int ret)
{
    size_t errlen = regerror(ret, re, NULL, 0);
    char *ebuf = malloc(errlen + 1);
    NEOERR *nerr;

    if(!ebuf)
        return nerr_raise_msg_errno("Regex Error");
    else {
        regerror(ret, re, ebuf, errlen + 1);
        nerr = nerr_raise(GENERIC_ERR, "%s: %s", prefix, ebuf);
        free(ebuf);
        return nerr;
    }
}

```

re_subst(*re*, *subst*, *string*) Substitute occurrences of URL-encoded POSIX extended regular expression *re* with URL-encoded *subst* string in (non-URL-encoded) *string*. In *subst*, backslash escapes are supported:

- `\\` means backslash
- `\0` means the entire matching string
- `\n`, where *n* is a decimal number, means the *n*th parenthesized subexpression
- `\,` means nothing (so you can separate `\n` from literal decimal digits)
- `\g` also means nothing, but has the side effect that all occurrences of the regular expression are substituted. If this is not present, only the first occurrence is substituted.

The behavior of any other character following a backslash, or a backslash at the end of a string, is undefined.

40b *<Initialize templates 22a>+≡* (18a) <39d 42a>

```
nerr_op(cs_register_function(cs, (char *)"re_subst", 3, cs_re_subst));
```

41 *<impl.c 17b>+≡* <39f 42b>

```
NEOERR *cs_re_subst(CSPARSE *cs, CS_FUNCTION *csf, CSARG *args, CSARG *result)
{
    regex_t re;
    int ret;
    char *in_p = NULL, *in, *subst = NULL, *re_s = NULL;
    char *s;
    NEOERR *nerr;
    int matchno, max_match;
    regmatch_t *matches;
    GString *subst_out;
    gboolean global = FALSE;
    int exec_opts;

    nerr = cs_arg_parse(cs, args, "sss", &re_s, &subst, &in_p);
    if(nerr != STATUS_OK) {
        if(in_p)
            free(in_p);
        if(re_s)
            free(re_s);
        if(subst)
            free(subst);
        return nerr;
    }
    cgi_url_unescape(subst);
    for(s = subst, max_match = 0; *s; s++)
        if(*s == '\\') {
            if(isdigit(s[1])) {
                matchno = atoi(s + 1);
                if(matchno > max_match)
                    max_match = matchno;
            } else if(s[1]) {
                s++;
                if(*s == 'g')
                    global = TRUE;
            }
        }
    matches = calloc(sizeof(*matches), max_match + 1);
    if(!matches) {
        free(re_s);
        free(subst);
        free(in_p);
        return nerr_raise_msg_errno("No memory for subst");
    }
    cgi_url_unescape(re_s);
    ret = regcomp(&re, re_s, REG_EXTENDED);
    if(ret) {
        free(matches);
        nerr = nerr_pass(regerr_nerr(re_s, &re, ret));
        free(re_s);
        return nerr;
    }
    free(re_s);
    subst_out = g_string_new("");
    exec_opts = 0;
    in = in_p;
    while(!regexec(&re, in, max_match + 1, matches, exec_opts)) {
        char *b;

        if(matches[0].rm_so)
```

41 `<tmpl.c 17b>+≡` `<39f 42b>`

```

    g_string_append_len(subst_out, in, matches[0].rm_so);
    s = subst;
    while ( (b = strchr(s, '\\')) ) {
        if (b != s)
            g_string_append_len(subst_out, s, (int) (b - s));
        if (isdigit(++b)) {
            matchno = atoi(b);
            while (isdigit(++b));
            if (matches[matchno].rm_so != -1 &&
                matches[matchno].rm_eo > matches[matchno].rm_so)
                g_string_append_len(subst_out, in + matches[matchno].rm_so,
                                    matches[matchno].rm_eo - matches[matchno].rm_so);
        } else if (*b) {
            if (*b != 'g' && *b != ',')
                g_string_append_c(subst_out, *b);
            b++;
        }
        s = b;
    }
    if (*s)
        g_string_append(subst_out, s);
    /* non-overlapping global, like sed */
    in += matches[0].rm_eo;
    if (!global)
        break;
    exec_opts |= REG_NOTBOL;
    /* only allow empty patterns to match once */
    if (!matches[0].rm_so && !matches[0].rm_eo)
        break;
}
if (*in)
    g_string_append(subst_out, in);
free(matches);
free(subst);
free(in_p);
regfree(&re);
result->n = 0;
result->op_type = CS_TYPE_STRING;
result->alloc = 1;
result->s = g_string_free(subst_out, FALSE);
return STATUS_OK;
}

```

re_extract(variable [+ ',' + variable ...], re, string) Extract substrings of (non-URL-encoded) *string* matching parenthesized subexpressions in URL-encoded POSIX extended regular expression *re*. The first such match is assigned to the first named *variable*, the second is assigned to the second named *variable*, and so forth. Blank variable names can be used to skip particular subexpressions. The return value is 1 if the regular expression matched. Otherwise, no variable assignments were made, and 0 is returned.

42a `<Initialize templates 22a>+≡` `(18a) <40b 44a>`

```

nerr_op(cs_register_function(cs, (char *) "re_extract", 3, cs_re_extract));

```

42b `<tmpl.c 17b>+≡` `<41 44b>`

```

NEOERR *cs_re_extract(CSPARSE *cs, CS_FUNCTION *csf, CSARG *args, CSARG *result)
{
    regex_t re;
    int ret;

```

42b <impl.c 17b>+≡

<41 44b>

```

char *vars = NULL, *re_s = NULL, *in_s = NULL;
char *s;
NEOERR *nerr = STATUS_OK;
int nmatch, matchno;
regmatch_t *matches;
gboolean matched;

nerr = cs_arg_parse(cs, args, "sss", &vars, &re_s, &in_s);
if(nerr != STATUS_OK) {
    if(vars)
        free(vars);
    if(re_s)
        free(re_s);
    if(in_s)
        free(in_s);
    return nerr;
}
for(nmatch = 0, s = vars; s && *s; nmatch++) {
    s = strchr(s, ',');
    if(s)
        *s++ = 0;
}
if(nmatch) {
    matches = calloc(sizeof(*matches), nmatch + 1);
    if(!matches) {
        free(vars);
        free(re_s);
        free(in_s);
        return nerr_raise_msg_errno("No memory for subst");
    }
} else
    matches = NULL;
cgi_url_unescape(re_s);
ret = regcomp(&re, re_s, REG_EXTENDED);
if(ret) {
    if(matches)
        free(matches);
    nerr = nerr_pass(regerr_nerr(re_s, &re, ret));
    free(vars);
    free(re_s);
    return nerr;
}
free(re_s);
matched = !regexexec(&re, in_s, nmatch ? nmatch + 1 : 0, matches, 0);
if(matched) {
    for(s = vars, matchno = 1; matchno <= nmatch; matchno++, s += strlen(s) + 1) {
        if(*s) {
            int so = matches[matchno].rm_so, eo = matches[matchno].rm_eo;

            if(so == -1 || eo <= so)
                nerr = nerr_pass(hdf_set_value(cs->hdf, s, ""));
            else {
                char c = in_s[eo];

                in_s[eo] = 0;
                nerr = nerr_pass(hdf_set_value(cs->hdf, s, in_s + so));
                in_s[eo] = c;
            }
        }
    }
    if(nerr != STATUS_OK) {
        free(vars);
        free(in_s);
        if(matches)
            free(matches);
    }
}

```

42b ⟨impl.c 17b⟩+≡ <41 44b>

```

        regfree(&re);
        return nerr;
    }
}
free(vars);
free(in_s);
if(matches)
    free(matches);
regfree(&re);
result->op_type = CS_TYPE_NUM;
result->s = NULL;
result->n = !!matched;
return STATUS_OK;
}

```

grep(*file*, *string*) Return the first line in *file* on the server matching POSIX extended regular expression *string*. If no lines match, a blank string is returned. The file name may not contain the vertical bar character. The primary intended purpose for this function is to look up password file entries in alternate password files.

44a ⟨Initialize templates 22a⟩+≡ (18a) <42a 45a>

```
nerr_op(cs_register_function(cs, (char *)"grep", 2, cs_grep));
```

44b ⟨impl.c 17b⟩+≡ <42b 45b>

```

NEOERR cs_grep(CSPARSE *cs, CS_FUNCTION *csf, CSARG *args, CSARG *result)
{
    char *pat = NULL, *fname = NULL;
    FILE *f = NULL;
    GString *res = NULL;
    regex_t re;
    int ret;
    NEOERR *nerr;

    nerr = cs_arg_parse(cs, args, "ss", &fname, &pat);
    if(nerr != STATUS_OK) {
        if(fname)
            free(fname);
        if(pat)
            free(pat);
        return nerr;
    }
    f = fopen(fname, "r");
    if(!f) {
        nerr = nerr_raise_errno(NERR_IO, "%s", fname);
        free(fname);
        free(pat);
        return nerr;
    }
    free(fname);
    ret = regcomp(&re, pat, REG_EXTENDED | REG_NOSUB);
    if(ret) {
        fclose(f);
        nerr = nerr_pass(regerr_nerr(pat, &re, ret));
        free(pat);
        return nerr;
    }
    free(pat);
    result->op_type = CS_TYPE_STRING;
}

```

44b <tpl.c 17b>+≡ <42b 45b>

```

result->n = 0;
result->alloc = 1;
while(g_string_fgets(&res, 0, f)) {
    while(res->len > 0 && (res->str[res->len - 1] == '\n' ||
        res->str[res->len - 1] == '\r'))
        res->len--;
    if(!regexec(&re, res->str, 0, NULL, 0)) {
        result->s = g_string_free(res, FALSE);
        fclose(f);
        return STATUS_OK;
    }
}
regfree(&re);
g_string_free(res, TRUE);
result->s = strdup("");
return STATUS_OK;
}

```

eval_tmpl(*template*) Evaluate *template* as a template. Unlike `lvar` and `eval`, the results can be assigned to a variable for further processing. Note that the simple implementation of this function always crashes. The HDF is probably being shared, so it is duplicated and then destroyed. This means that any side effects are lost. This function also requires the use of the generic function interface; without it only the global HDF may be used by the template.

45a <Initialize templates 22a>+≡ (18a) <44a

```
nerr_op(cs_register_function(cs, (char *)"eval_tmpl", 1, cs_eval_tmpl));
```

45b <tpl.c 17b>+≡ <44b

```

NEOERR *cs_eval_tmpl(CSPARSE *cs, CS_FUNCTION *csf, CSARG *args, CSARG *result)
{
    GString *out_str;
    NEOERR *nerr;
    char *in = NULL;

    nerr = cs_arg_parse(cs, args, "s", &in);
    if(nerr != STATUS_OK) {
        if(in)
            free(in);
        return nerr;
    }
    out_str = g_string_new("");
    nerr = nerr_pass(tmpl_string(in, cs->hdf, out_str, TRUE));
    free(in);
    if(nerr != STATUS_OK) {
        g_string_free(out_str, TRUE);
        return nerr;
    }
    result->op_type = CS_TYPE_STRING;
    result->n = 0;
    result->s = g_string_free(out_str, FALSE);
    result->alloc = 1;
    return nerr;
}

```

A simple program is provided to strip ClearSilver from templates, supporting these functions.

45c $\langle(\text{build.nw})\text{ C Executables }45\text{c}\rangle\equiv$

```
display_template \
```

46a $\langle(\text{display_template.c }46\text{a})\equiv$

```
 $\langle(\text{build.nw})\text{ Common C Includes }1\rangle$ 
#include "cproto.h"

void help(void)
{
}

const char *config_root = ".";
const char *config_path = "display_template.conf";

int main(int argc, const char **argv)
{
   $\langle\text{Common Mainline Variables }5\text{f}\rangle$ 
  const char *tmpl;

  if(argc <= 1)
    return 0;
  argc--;
  tmpl = ++argv;
   $\langle\text{Read configuration }8\text{g}\rangle$ 
  if(nerr == STATUS_OK) {
    GString *cwd = g_string_new("");

    nerr = nerr_pass(getcwd_gs(cwd));
    nerr_op(hdf_set_value(local_config, "hdf.loadpaths.cwd", cwd->str));
    g_string_free(cwd, TRUE);
  }
  nerr_op(hdf_set_value(local_config, "Config.VarEscapeMode", "html"));
  nerr_op(tmpl_file(tmpl, local_config, stdout, FALSE));
  ret = 0;
  if(nerr != STATUS_OK) {
    nerr_log_error(nerr);
    ret = 1;
  }
  return ret;
}
```

46b $\langle(\text{cs_supt.c }5\text{e})+\equiv$

$\triangleleft 40\text{a}$

```
NEOERR *getcwd_gs(GString *gs)
{
  if(!gs->allocated_len)
    g_string_set_size(gs, 32);
  while(1) {
    if(getcwd(gs->str, gs->allocated_len))
      return STATUS_OK;
    if(errno == EAGAIN || errno == EINTR)
      continue;
    if(errno != ERANGE)
      return nerr_raise_msg_errno("getting current directory");
    g_string_set_size(gs, gs->allocated_len * 2);
  }
}
```

5 HTML Templates

All of the HTML templates have to start with the wordy HTML document type header. Since heavy use of ClearSilver macros would invalidate most HTML files anyway, this is placed in a standard header file. It's also provided as a code chunk to make creation of plain HTML easier.

47a `<CS files 47a>≡` (19e)

```
html_prefix.cs \
```

47b `<html_prefix.cs 47b>≡`

```
<?cs <(build.nw) Common NoWeb Warning 3c>
?><Standard HTML Prefix 47c>
```

47c `<Standard HTML Prefix 47c>≡` (47b)

```
<!DOCTYPE html PUBLIC "-//W3C//DTD XHTML 1.0 Transitional//EN"
"http://www.w3.org/TR/xhtml1/DTD/xhtml1-transitional.dtd">
<html xmlns="http://www.w3.org/1999/xhtml" xml:lang="en" lang="en">
<head>
```

In addition to the diagrams, embedded HTML should have some sort of preview picture. The perl `html2ps` utility can be used for this, if file and button fields are converted to plain input fields. Also, ClearSilver escape sequences cause `html2ps` to produce bad output, so the `display_template` program (`<display_template.c 46a>`) is used to run the template through ClearSilver with any required extensions. Since these pages can get quite large, they can be split using `<div>` tags. The figures can then either be the entire HTML, just the HTML before the first `<div>`, or the HTML contained in a single `<div>`. Nested `<div>`s are not supported. The preview looks very little like the page would look in a browser. Rather than supporting arbitrary `<div>` names by extracting them from the NoWeb file, the only supported names are `div1`, `div2`, ... `div9`.

47d `<(build.nw) makefile.vars 2a>+≡` <20f

```
HTML_FILES=$(shell $ (NOROOT) $(NOWEB) | sed -n '/\.html>>/{s/<<\/;s/>>\/;};}')
HTML2PS=html2ps -D -s 0.4 -S "@html2ps { prefilled:1; }" -o
HTML2PS_SEDFORM=s/\(<input[>]*\) type="[fFbBsS]"[^\"]*"*/\1/g;
```

47e `<(build.nw) makefile.rules 10c>+≡` <21 48b>

```
%eps: %.html display_template
./display_template $< | sed '$(HTML2PS_SEDFORM)' | $(HTML2PS) $@

%-main.eps: %.html display_template
./display_template $< | sed -n '$(HTML2PS_SEDFORM)/<div/,/<\/div>/!p' | \
$(HTML2PS) $@

define eps_div
%-div$(1).eps: %.html display_template
./display_template $< | sed -n -e '$(HTML2PS_SEDFORM)' \
-e '/<body/{p;:a /<div/bb;n;ba;:b;}' \
-e '/div.*id="div$(1)" /,/<\/div>/p;' \
-e '/<div/,/<\/div>/!p' | \
$(HTML2PS) $<
endif

$(foreach i,1 2 3 4 5 6 7 8 9,$(eval $(call eps_div,$i)))
```


the provided functions, so `cproto` or something similar should be used to extract those first, like the build system normally does automatically. The following functions are provided:

```
char *g_string_fgets(GString **_buf,
                    guint offset,
                    FILE *f)
```

Retrieve a line into a `GString` buffer starting at the given `offset`, which may be initialized to `NULL`. The buffer will never be returned as `NULL`. The return value is a pointer to the string's buffer if there were no errors; use `ferror` and `feof` to determine the exact cause for a `NULL` return. Reading will terminate at the next newline. The string length will include the last newline, or the last character read, or the first ASCII NUL, whichever comes first.

```
char *g_string_fgets_bin(GString **_buf,
                        guint offset,
                        FILE *f)
```

Retrieve a line into a `GString` buffer starting at the given `offset`. Operation is identical to `g_string_fgets`, except that ASCII NUL characters in the input are not treated specially. This means that the result of `strlen` may differ from the string's `len` parameter.

```
char *g_string_gets_generic(GString **_buf,
                           guint offset,
                           gets_fp my_gets,
                           void *f,
                           gboolean allow_zero)
```

```
typedef char *(*gets_fp)(char *buf, int len, void *f);
```

Retrieve a line into a `GString` buffer starting at the given `offset`. The `my_gets` parameter replaces the standard `fgets` routine for reading the line, and takes the `f` parameter in place of the file. The `allow_zero` parameter distinguishes between the above two methods for determining the return length. This function may be used for reading something other than a standard `FILE`.

The `runit` utility simply takes the program to run, and its arguments, as its own argument. A file in `/tmp` with the same base name as the program to run, except with a `stop_` prefix, may be touched to temporarily delay execution of the program until the file is removed.

For programs which use the build facility, a number of other routines and definitions are also provided. For dealing with errors, the following macros and code chunks are provided.

- *Common Mainline Variables 5f* defines `nerr` and `ret` for tracking return codes. `nerr` is a `NEOERR` pointer and `ret` is an `int`.
- *Initialize logging 5g* is intended to be used in `main`. It stores the program name and initializes the ClearSilver error processing.
- `GENERIC_ERR` is a preinitialized generic `NEOERR` type for situations where the type does not matter. It is used with all generic message routines.
-

```
void die_if_err(NEOERR *err)
```

Prints `err` to standard error and exits the program if `err` is not `STATUS_OK`.

-

```
void die_msg(const char *msg)
```

Prints `msg` in the form of a ClearSilver error to standard error and exits the program.

-

```
void die_errno(const char *msg)
```

Prints `msg` in the form of a ClearSilver error with system error information and exits the program.

-

```
void die_errno_local(const char *msg,
                    int err)
```

Prints `msg` in the form of a ClearSilver error with system error information using `err` instead of `errno` to standard error and exits the program.

-

```
NEOERR *nerr_raise_msg(const char *msg)
```

Generates an error with a fixed message.

-

```
NEOERR *nerr_raise_msg_errno(const char *msg)
```

Generates an error with a fixed message and system error information.

-

```
NEOERR *nerr_raise_errno_local(const char *msg,
                              int err)
```

Generates an error with a fixed message and system error information using `err` instead of `errno`.

-

```
void nerr_op(NEOERR *op)
```

Only executes `op` if the local variable `nerr` is `STATUS_OK`, and if so, it updates `nerr` to `op`'s return code.

-

```
gboolean nerr_op_ok(NEOERR *op)
```

Only executes `op` if the local variable `nerr` is `STATUS_OK`, and then also updates `nerr` to `op`'s return code. If and only if `nerr` is `STATUS_OK` still after this, `TRUE` is returned.

- *⟨Convert `nerr` to `err_str 6b⟩`* creates a `STRING` called `err_str`, which contains an expanded string version of the error stored in the local variable `nerr`.

•

```
NEOERR *gerr_to_nerr(const GError *gerr)
```

Converts a GLib error to a ClearSilver error. Note that this macro, unlike the others, evaluates `err` multiple times.

For dealing with configuration files in ClearSilver HDF format, the following macros, functions, variables, and code chunks are provided. In addition, configuration files which use the multi-line literal here-doc style syntax starting with a double-less-than may use `EOV` as their termination literal, and have the termination literal forced to the left margin even if the code chunk is indented.

- *⟨Read configuration 8g⟩* reads the primary configuration file, and processes keyword-value pairs and file references on the command line. It already includes the log initialization above. On failures, it calls `void help(void)`, which it assumes exits the program.
- *⟨Help Function 13b⟩* is a generic help function (`void help(void)`) which displays the command-line syntax, program description, and configuration parameters. In order to do so, the program description for a program called `<program>` would need to be a single-line chunk named *⟨<program> Description (imported)⟩*, and its configuration parameters would need to be in a chunk named *⟨<program> Configuration (imported)⟩*. The format of the configuration parameters should be one block of comments per configuration parameter, with the description above the parameter. The description comments each have a space before the text, and the parameter is an assignment to the default value, commented out, with no space after the comment character or surrounding the equals sign. Each configuration parameter should be followed by a blank line to separate it from the next.
- *⟨ClearSilver Configuration Documentation 9c⟩* may be prepended to a configuration file to provide basic documentation of the configuration file format. An additional blurb may be necessary at the start to indicate the default file name and environment overrides.
- `const char *config_root` is a global variable which must be defined in a program using these facilities. It is the default search path for configuration files, and may be overridden with the environment variable `CONFIG_ROOT`. A default path derived from the project name can be inserted using *⟨Default config_root 8d⟩*.
- `const char *config_path` is a global variable which must be defined in a program using these facilities. It is the default configuration file name, and may be overridden with the environment variable `CONFIG_FILE`. A default name derived from the project name can be inserted using *⟨Default config_path 8e⟩*.
- HDF `*local_config` is a global variable which contains the primary configuration for a program. This is read from the configuration file under a section named the same as the executable.

•

```
const char *getconf(const char *name,
                   const char *def)
```

Returns the value of a configuration variable in `local_config`, or `def` if not found or the parameter has no value (i.e. it is only the parent of another configuration value).

•

```
gint64 getconf_int(const char *name,
                  gint64 def)
```

Returns the value of an integer configuration variable in `local_config`, or `def` if not found or the parameter has no value (i.e. it is only the parent of another configuration value).

-

```
HDF *getconf_first(const char *name)
```

Returns the first child of the given configuration parameter.

-

```
HDF *getconf_first_sorted(const char *name)
```

Returns the first child of the given configuration parameter after sorting the children alphanumerically.

-

```
gint64 hdf_get_int64_value(HDF *hdf,
                          const char *name,
                          gint64 def)
```

Returns the value of an integer variable in `hdf`, or `default` if not found or the parameter has no value (i.e. it is only the parent of another configuration value). It is the 64-bit integer equivalent of `hdf_get_int_value`, except that it kills the program, rather than using the default value, if the parameter exists, but is not an integer.

-

```
gint64 getconf_hier_int(const char *parent,
                      HDF *obj,
                      const char *name,
                      gint64 def)
```

Returns the same value as `hdf_get_int64_value(obj, name, default)`, except that the message it displays on failure adds `parent` to the failed node name displayed in the message.

-

```
NEOERR *hdf_set_int64_value(HDF *hdf,
                          const char *name,
                          gint64 val)
```

Sets the named parameter to the string form of the integral value. This is the 64-bit equivalent of `hdf_set_int_value`.

-

```
HDF *hdf_first_child(HDF *hdf,
                    const char *name)
```

Returns the first child of the named variable in `hdf`.

-

```
HDF *hdf_first_child_sort(HDF *hdf,
                          const char *name)
```

Returns the first child of the named variable in `hdf` after sorting the children alphanumerically.

•

```
void env_override(const char *env,
                 const char *&var)
```

Sets `var` to the value of environment variable `env` if a variable by that name exists.

•

```
void prepend_dir_if_relative(const char *def_dir,
                            const char *&fn)
```

Sets `fn` to a heap-allocated string consisting of `dir`, followed by the old contents of `fn`, separated by a slash, if `fn` does not begin with a slash.

•

```
int comp_hdf_name(const void *_a,
                  const void *_b)
```

A comparison function which may be used with `hdf_sort_obj` to achieve an alphanumeric sort with numbers sorted first, and numeric prefixes sorted as numbers even if followed by alphabetic characters.

In addition, support is provided for using `gperf` to convert string values to numeric enumeration constants. The strings to hash are specified in chunk names like *prefix-gperf-suffix*. Strings are separated by newlines or single spaces; commas and spaces are not allowed in the strings. The *prefix* is the base name of the output files; the C code is generated in *prefix.c.gperf*, and the enumerations are built in *prefix.h.gperf*. These should be included directly in the C and header files that use them. Each unique *suffix* generates a different hash function and enumeration type. The enumeration type is named *suffix_t*, and the hash lookup function is named *suffix_id*. The *suffix* must be a valid C identifier. The enumeration identifiers are called *SUFFIX_STRING*, where *SUFFIX* is *suffix* converted to upper-case, and *STRING* is the string with all alphabetic characters in upper-case and all non-alphanumeric characters converted to underscores. This means that strings differing only in case or special characters cannot coexist in the same hash table. One additional enumeration literal, *UNKNOWN_SUFFIX*, is given the value zero, which is returned if the string is not found. The only option which may be set is case-sensitivity. A case-insensitive hash can be generated by using `-gperf-nc-` instead of `-gperf-`; the `nc-` part is not considered to be part of the *suffix*.

The templates use the standard ClearSilver syntax (see your installed ClearSilver package, or http://www.clearsilver.net/docs/man_templates.hdf).

To support templates, the following functions, variables, and code chunks are defined. In addition, files added to the *<CS Files (imported)>* chunk are plain files which are also post-processed to remove the final newline. This gets around a NoWeb limitation wherein any code chunk has a terminating newline, and allows for pure macro libraries which do not affect output.

- `tmpl_dir` is a global variable which is a subdirectory of `config_root` which is the default search path for template files. Its default value is `tmpl`, and it can be overridden by the `tmpl_dir` configuration parameter, as described in *<Template Parameter Configuration 18d>*, a chunk which should be included in your configuration files. To install the templates in the default location, the *<Install ClearSilver templates 20d>* chunk should be added to *<(build.nw) Install other files 11c>*.

•

```
NEOERR *tmpl_string(const char *tmpl,
                   HDF *parms,
                   GString *out,
                   gboolean raw)
```

Evaluates the template `tmpl` and places the results in `out`. Variable values are retrieved from `parms`. The `raw` option may be `TRUE` to make the default conversion option for the template `raw`. Note that setting this will cause `parms` to be temporarily modified, in addition to any modifications the template may cause.

-

```
NEOERR *tmpl_string_to_file(const char *tmpl,
                           HDF *parms,
                           FILE *out,
                           gboolean raw)
```

Evaluates the template `tmpl` and places the results in `out`. Variable values are retrieved from `parms`. The `raw` option may be `TRUE` to make the default conversion option for the template `raw`. Note that setting this will cause `parms` to be temporarily modified, in addition to any modifications the template may cause.

-

```
NEOERR *tmpl_string_to(const char *tmpl,
                       HDF *parms,
                       CSOUTFUNC outf,
                       void *outp,
                       gboolean raw)
```

A generic template string evaluator, which sends its output via `outf`, which is passed `outp`. Variable values are retrieved from `parms`. The `raw` option may be `TRUE` to make the default conversion option for the template `raw`. Note that setting this will cause `parms` to be temporarily modified, in addition to any modifications the template may cause.

-

```
NEOERR *tmpl_file(const char *tmpl,
                  HDF *parms,
                  FILE *out,
                  gboolean raw)
```

Evaluates the template file `tmpl` and places the results in `out`. Variable values are retrieved from `parms`. The `raw` option may be `TRUE` to make the default conversion option for the template `raw`. Note that setting this will cause `parms` to be temporarily modified, in addition to any modifications the template may cause.

-

```
NEOERR *tmpl_file_to_string(const char *tmpl,
                            HDF *parms,
                            GString *out,
                            gboolean raw)
```

Evaluates the template `tmpl` and places the results in `out`. Variable values are retrieved from `parms`. The `raw` option may be `TRUE` to make the default conversion option for the template `raw`. Note that setting this will cause `parms` to be temporarily modified, in addition to any modifications the template may cause.

-

Format	Example
%Y-%m-%d %T	2008-06-13 18:07:10
%Y-%m-%d %R	2008-06-13 18:07
%Y-%m-%d	2008-06-13
%m/%d/%Y %T	6/13/2008 18:07:10
%m/%d/%Y %R	6/13/2008 18:07
%m/%d/%Y	6/13/2008
%d-%m-%Y %T	13-06-2008 18:07:10
%d-%m-%Y %R	13-06-2008 18:07
%d-%m-%Y	13-06-2008
%T	18:07:10
%R	18:07
%a %T	Friday 18:07:10
%a %R	Friday 18:07
%a	Friday
%b %Y	June 2008
%b	June
%c	Fri Jun 13 18:07:10 2008
%x	06/13/08

Table 2: Default formats for `parse_date`

```
NEOERR *tmpl_file_to(const char *tmpl,
                     HDF *parms,
                     CSOUTFUNC outf,
                     void *outp,
                     gboolean raw)
```

A generic template file evaluator, which sends its output via `outf`, which is passed `outp`. Variable values are retrieved from `parms`. The `raw` option may be `TRUE` to make the default conversion option for the template `raw`. Note that setting this will cause `parms` to be temporarily modified, in addition to any modifications the template may cause.

- `display_template` is a program which displays a ClearSilver template using the above functions with a simplified search path of the current directory.

All of the above template evaluators also add a few ClearSilver functions which may be used by the template:

`parse_date(formats, date)` Parse an absolute date in server's current locale using `strptime(3)` or a relative date using a custom format and return as seconds since UNIX epoch. The *formats* string consists of zero or more formats separated by vertical bars (`|`). The formats in the "Default formats for `parse_date`" table are appended to the given formats, in order (examples are for Friday, June 13, 2008, 18:07:10, with adjustments described below). The first format which matches the *date* will be used.

Since `strptime(3)` does not support time zones, the time zone is always the server's local time zone. This can be changed for subsequent formats by using the format `TZ=zone`. Note that the format of the *zone* string is operating system-dependent. See `tzset(3)` for details. If any of hours, minutes, or seconds are not present, they are set to zero. If the month is specified, but not the day, the first of the month is used. If only the year is specified, January 1 is used. These formats also support some relative times. If the year is unspecified, it is the current year, unless the day of year is specified, either by month or day of year, and that day is on or after today, in which case it is last year. If only the weekday is specified, then it is the last such weekday, excluding today. In the previous examples, the

`%a` format only works between Saturday, June 14, and Friday, June 20, and the `%b` format only works between July 1, 2008, and June 30, 2009.

For specifically relative dates, the date must consist of a star (*), implying the current date, optionally followed by an offset. The offset is an optional sign (+ or -; - is default), followed by an optional count (1 is the default), followed by an optional case-insensitive interval length indicator for seconds (S), minutes ('), hours (H), days (D) (the default), months (M), or years (Y). For a valid offset, one or the other of the count or the interval length indicator must be present. All parts of the date finer than the specified interval are set to their lowest value. For example, if the interval is in months, then the day is set to the first of the month, and the time is set to midnight.

Finally, a blank input returns 0, always.

format_date(*format*, *timestamp*) Format date using `strftime(3)`, with optional *format*. A blank *format* is replaced by `%c`. The *timestamp* is seconds since UNIX epoch.

url_unescape(*string*) URL-decode *string* (URL-encoding is provided by the CGI library as `url_escape(string)`)

json_escape(*variable-name*) Escape *variable* and its children using JavaScript Object Notation (JSON). See <http://www.json.org> for the complete format specification. Nonexistent variables and variables without values or children are output as `null`. Variables with values are output as strings by default, but may be output as numbers by adding the `num` attribute, and may be output as booleans by adding the `bool` attribute; booleans with no value, blank values, or the value 0 are output as `false`. Variables with children are output as objects by default, but may be output as arrays (i.e., children names are sorted, but not output) by adding the `array` attribute; arrays with no value are output as an empty array, but there is no way to output an empty object (`{ }`). String values must be UTF-8 encoded. If any variables have raw values which may conflict with UTF-8, they should be double-encoded using e.g. URL-encoding to ensure that their value is converted to ASCII first.

json_unescape(*variable-name*, *value*) Set *variable* to the result of parsing *value* using JavaScript Object Notation (JSON). See <http://www.json.org> for the complete format specification. Arrays will have their `array` attribute set and their children will receive numeric sequence names. Booleans will be set to 1 for `true` and blank for `false` and have their `bool` attribute set. Numbers will have their `num` attribute set. Unicode escapes in the string will be encoded as per UTF-8.

to_hex(*bin*) Convert a URL-encoded binary blob to a string of lower-case hexadecimal digits. This is mostly for displaying checksums. The blob must be URL-encoded so that zeroes are handled properly in the string.

from_hex(*hex*) Convert a string of hexadecimal digits to a URL-encoded binary blob. This is mostly for converting checksums from their usual format to that expected by these utilities. The return must be URL-encoded to prevent issues with zeroes in string returns.

to_lower(*string*) Convert *string* to lower-case in the server's current locale. This is done a byte at a time using the `ctype.h` function. This means that the string will probably be mangled in UTF-8 locales or if the input locale does not match the server's locale.

to_upper(*string*) Convert *string* to upper-case. The comments for `to_lower()` apply here as well.

pw_uid(*id*) Return the password file entry for the given user ID on the local system. Since this uses the system function, it may not be a real file entry, but it is returned in the format of one.

pw_nam(*name*) Return the password file entry for the given user name on the local system. Since this uses the system function, it may not be a real file entry, but it is returned in the format of one.

re_match(*re*, *string*) Return integer flag 1 if URL-encoded POSIX extended regular expression *re* matches (non-URL-encoded) *string*.

re_subst(*re*, *subst*, *string*) Substitute occurrences of URL-encoded POSIX extended regular expression *re* with URL-encoded *subst* string in (non-URL-encoded) *string*. In *subst*, backslash escapes are supported:

- `\\` means backslash
- `\0` means the entire matching string
- `\n`, where *n* is a decimal number, means the *n*th parenthesized subexpression
- `\,` means nothing (so you can separate `\n` from literal decimal digits)
- `\g` also means nothing, but has the side effect that all occurrences of the regular expression are substituted. If this is not present, only the first occurrence is substituted.

The behavior of any other character following a backslash, or a backslash at the end of a string, is undefined.

re_extract(*variable* [+ '*'* + *variable* ...], *re*, *string*) Extract substrings of (non-URL-encoded) *string* matching parenthesized subexpressions in URL-encoded POSIX extended regular expression *re*. The first such match is assigned to the first named *variable*, the second is assigned to the second named *variable*, and so forth. Blank variable names can be used to skip particular subexpressions. The return value is 1 if the regular expression matched. Otherwise, no variable assignments were made, and 0 is returned.

grep(*file*, *string*) Return the first line in *file* on the server matching POSIX extended regular expression *string*. If no lines match, a blank string is returned. The file name may not contain the vertical bar character. The primary intended purpose for this function is to look up password file entries in alternate password files.

eval_tmpl(*template*) Evaluate *template* as a template. Unlike `lvar` and `eval`, the results can be assigned to a variable for further processing.

For HTML templates, `html_prefix.cs` can be included in any file to remove the need to declare the document type as `xhtml`. Also, the HTML template can be run through `display_template` to create a preview picture in the document using `\includegraphics` with the base name of the HTML file. If the HTML file is too large for a single preview, it can be split using `<div>` tags with an id of `div1`, `div2`, and so forth. The portion of the HTML outside of the `divs` is named the same as the base name of the HTML file, but with `-main` tacked on, and the divisions are similarly named with `-div1`, etc. tacked on. If a graphical preview is inappropriate, and the HTML is simple enough, the HTML can be included by converting it to raw \LaTeX with the `\htmlinput` directive. The dependency this adds to the PDF on the HTML output must be added to `<(build.nw) makefile.rules 10c>` manually.

A few miscellaneous items are also defined.

- `debug` is a global variable set to the value of the `debug` integer parameter. It should not normally be documented in the default configuration file.

-

```
NEOERR *getcwd_gs(GString *gs)
```

Retrieves the full current working directory into a dynamic string.

-

```
GString *g_string_append_json(GString *buf,
                              HDF *hdf)
```

Appends the JSON encoding of `hdf` onto the string `buf`. See the ClearSilver function `json_escape` for details.

•

```
NEOERR *json_from_string(const char *s,
                        HDF *hdf)
```

Converts the JSON-encoded string `s` into values for the HDF hierarchy `hdf`. See the ClearSilver function `json_unescape` for details.

•

```
NEOERR *embedded_json_from_string(const char *s,
                                HDF *hdf,
                                const char **ep)
```

Converts the JSON-encoded string `s` into values for the HDF hierarchy `hdf`. If `ep` is not NULL, a pointer to the text after the parsed value is returned. Otherwise, the text after the parsed value is simply ignored. See the ClearSilver function `json_unescape` for details.

•

```
GString *append_unicode_quoted(GString *buf,
                              const char *s)
```

Converts the string `s` into a JSON-encoded string value, including quote delimiters.

7 Code Dependencies

This application depends on several tools and libraries not included in this document. Required build tools include the build document provided along with this document, NoWeb, GNU make, cproto, and obviously a working C compiler. If the string-to-enum support is used, gperf is needed as well. Required libraries (with headers, so “development” versions) include GLib and ClearSilver. See the first mention of each of these in the document for where to get it (if not from your OS vendor) and what version is required.

The data types provided by the used libraries need to be highlighted, as well.

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<28b

```
% GLib
gboolean, gint8, guint8, gint16, guint16, gint32, guint32, gint64, guint64, %
gchar, guchar, gint, guint, glong, gulong, GString, GStringChunk, GArray, GByteArray, %
GPtrArray, gconstpointer, gpointer, GMemChunk, GDir, GError, %
% ClearSilver
HDF, NEOERR, NERR_TYPE, CGI, CSPARSE, STRING, CSOUTFUNC, %
```

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