Dynamic space relocation

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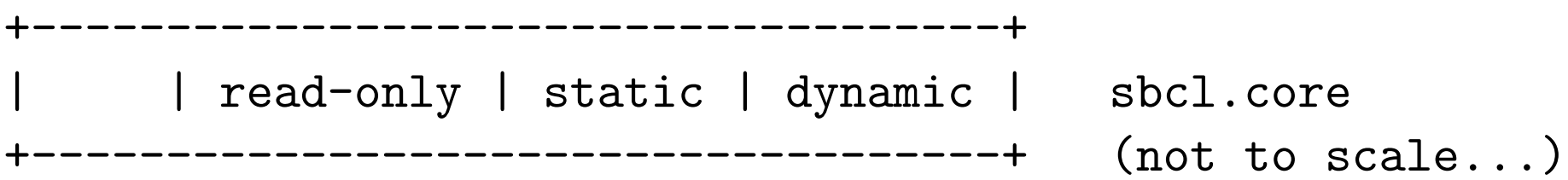
SBCL memory layout



`mmap` each of them at startup to (Linux/x86):

- A few bytes of read-only space at #x01000000
- A few bytes of static space at #x01100000
- 512 MB of dynamic space #x09000000 to #x29000000

Issues # 1

- Why maintain this table manually in the first place?

Issues # 2

- What if Linux/nonmainstreamhardware now has the stack at #x10000000?
- Would like `sbcl.so`, runnable in an existing process. What if the host process has something `mmap()`ed at #x25000000?
- Microsoft Windows

Solution

Relocate spaces at startup to a suitable locations
(Dynamic space only at this point.)

The relocation patch in a nutshell

```
 os_vm_address_t
-os_validate(os_vm_address_t addr, os_vm_size_t len)
+os_validate(os_vm_address_t addr, os_vm_size_t len, int fixedp)
 {
     int flags = MAP_PRIVATE | MAP_ANON;

-    if (addr)
+    if (addr && fixedp)
         flags |= MAP_FIXED;

     addr = mmap(addr, len, OS_VM_PROT_ALL, flags, -1, 0);

     if (addr == MAP_FAILED) {
         perror("mmap");
         return NULL;
     }

     return addr;
 }
```

(*BSD version)

API

Describe which part of memory moves where (can relocate multiple such segments simultaneously).

```
struct relocation_segment {
  long *old_start;
  long *old_end;
  long displacement;
};
```

fixme: currently assumes sizeof(long)=sizeof(void*), will break on 64bit Windows

Random API functions

Dynamic space relocation: Segment at *ptr*, relocate from old position *old_start* to new position *old_start* + *displacement*:

```
void relocate_single(
        long *ptr, long nwords, long *old_start, long displacement);
```

Static space fixup: Segment unchanged, put points to something that has moved:

```
void
relocation_fixup(long *fixup_ptr,
                 long n_fixup_words,
                 int nsegments,
                 struct relocation_segment *segments);
```

See other talk for use case: Segments still at old position, each relocated in place for a future position:

```
void relocate_all(int nsegments, struct relocation_segment *segments);
```

looks mostly just like scav_* or ptrans_*

```
static void
sub_relocate(long *ptr, long nwords, struct relocator *ctx)
{
        int nsegments = ctx->nsegments;
        struct relocation_segment *segments = ctx->segments;

        long *p;
        long *q = ptr + nwords;
        long nrelocated;
        int i;

        for (p = ptr; p < q; p += nrelocated) {
                long word = *p;
                if (is_lisp_pointer(word)) {
                        long *address = (long *) native_pointer(word);
                        for (i = 0; i < nsegments; i++)
                                if (segments[i].old_start <= address
                                    && address < segments[i].old_end)
                                {
                                    *p += ctx->segments[i].displacement;
                                    break;
                                }
                        nrelocated = 1;
                } else {
                        relocfn fn = reloctab[widetag_of(word)];
                        if (fn)
                                nrelocated = fn(p, ctx);
                        else
                                nrelocated = 1;
                }
        }
}
```

Demonstration