Address & Thread Sanitizer in GCC 4.8

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Outline

Address Sanitizer Status

Thread Sanitizer Status

Now let's talk about ...

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A brief recap

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  - Instruments each memory access.
  - Checks if it's OK to access memory at that address.
  - Emits an error when accessing a non-valid address.
  - libsanitizer runtime library replaces malloc/free functions.
  - Addresses of freed memory are marked as being non-valid aka "poisoned".

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*address = ...;  // or: ... = *address;
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- Asan instruments it as:

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if (is_poisoned (address))
  {
    report_error (address, access_size, /*is_write=*/true);
  }
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- Each byte of shadow memory can take 9 different values (surprise, heh):
  - 0: All bytes in the corresponding 8-bytes region are accessible.
  - -1: All bytes in the corresponding 8-bytes region are non-accessible (aka poisoned).
  - k: The first k bytes of the 8-bytes region are poisoned.

Instrumentation principles: more of it

- So the "is_poisoned" function now becomes:

```
bool
is_poisoned (char *address, size_t access_size, bool is_write_access)
{
  /* Get the address of the shadow memory.  */
  char *shadow_address = mem_to_shadow (address);

  /*  And now check if the shadow value says we are accessing
      a poisoned memory slot ...  */
  char shadow_value = *shadow_address;
  if (shadow_value)
   {
     if (is_access_to_poisoned_memory (shadow_value, address, access_size))
       report_error (address, access_size, is_write_access);
   }
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- And the "is_access_to_poisoned" function is:

```
bool
is_access_to_poisoned_memory (char shadow_value char *address, char access_size)
{
   last_accessed_byte = (address & 7) + access_size - 1;
   return last_accessed_byte >= shadow_value;
}
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    - At the top of the stack
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    - At the bottom of the stack that contains metadata for the runtime: function name, number of variables, offset of the variables slot and their length.

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- Avoid instrumenting “adjacent” memory accesses to the same addresses in the same basic block.

```
variable = *the_pointer;
/* some stuff that don't touch the_pointer .... */
variable = *the_pointer; /* We shouldn't instrument this access to
                            the_pointer, right?  */
```

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  - Pro-actively propose killing features

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    - and there is no common lock held on their memory location
    - and either A or B is a write event.

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- Then the runtime does the magic of figuring out if two accesses to the same address from different threads represents a data race.

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- Don't instrument local variables which address don't escape.
- Don't instrument reads on global constants including vtables.

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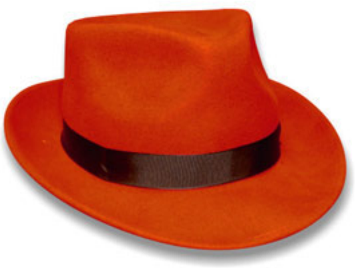

- Thank You!