

asm.js: Semantic additions for shared memory and atomics

Stable draft, 21 November 2014

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Note 2015-08-28: This specification is **OBSOLETE**. It has **MOVED TO GITHUB**. All open comment threads have been replicated as individual Issues on the moved spec.

At a glance:

- New constructors "Shared{Int,Uint}{8,16,32}Array" can be mapped onto the heap if the heap is a SharedArrayBuffer.
- It is a static error to reference, even for the purposes of storing it in a local binding, a shared-view constructor (eg, SharedInt32Array) and an unshared-view constructor (eg, Float64Array) in the same compilation unit.
- It is a link error to map a shared view onto an unshared buffer, or an unshared view onto a shared buffer. [2015/01/19]
- Loading from and storing to the heap have unchanged semantics if the heap is shared memory.
- There is a new known stdlib object "Atomics"
- There are new known methods "load", "store", "fence", "compareExchange", "add", "sub", "and", "or", and "xor" on the Atomics object.
- For all those operations except "fence":
 - The first argument must name a shared integer-typed array
 - The second argument must be an intish expression:
 - It signifies the element index within the array
 - It must satisfy the same constraints as a heap access expression: if the array is not a byte array then the expression must have the form c , where c is a constant, or the form $e \gg k$, where k is a constant that is the log-base-2 of the element size.¹
 - If the element index is not in the range of the array then
 - A memory barrier appropriate to the operation is performed
 - No read or write operation is performed
 - For load, compareExchange, and the binary operators the result value is zero
- Meaning of Atomics.load()
 - The result type is signed²
- Meaning of Atomics.store()
 - The third argument must be intish
 - The result value is the third argument value, coerced to signed

¹ Treating atomic accesses as "syntax" rather than as "calls" fits in with how they will be used and allows for simplifications in code generation, and is not (yet) seen as a particular hardship. There will be some spec complexity regardless.

² In principle it should be intish but that is not an allowed result type for a call.

- The result type is signed³
- Meaning of `Atomics.fence()`
 - The result type is void
- Meaning of `Atomics.compareExchange()`
 - The third argument must be intish
 - The fourth argument must be intish
 - The result type is signed
- Meaning of `Atomics.add()`, `Atomics.sub()`, `Atomics.and()`, `Atomics.or()`, `Atomics.xor()`
 - The third argument must be intish
 - The result type is signed
- Meaning of `Atomics.isLockFree`
 - The argument must be an integer constant
 - The result type is int (a boolean value)

The following `Atomics` names are *not* available as intrinsics in `asm.js`:

`Atomics.futexWait()`
`Atomics.futexWake()`
`Atomics.futexWakeOrRequeue()`
`Atomics.OK`
`Atomics.NOTEQUAL`
`Atomics.TIMEDOUT`

The `futex` methods can be accessed through the FFI (with the heap passed implicitly) and the result values can be expanded into constant values, as they have known values.

³ In principle it should perhaps be the concrete type of the third argument, which would be the case for an assignment to a typed array element, but this is a call and it needs a proper call return type