

Python Greenlets

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class greenlet

- static `getcurrent()`
- constructor (`run=None`, `parent=None`)
- fields (with mutators)
 - `run` (can be set by constructor, mutated later, or defined by subclasses)
 - `parent` (initially set by constructor, defaulting to the currently executing greenlet)
- methods
 - `switch(*args, **kwargs)`
 - `throw()`
 - `dead`
 - ...
- has a finalizer
- (implemented in C++ and assembly)

greenlet Hierarchy

- Invariant
 - Every greenlet is either (permanently) the "main" greenlet of a thread
 - Or a user greenlet with a "main" parent-ancestor (i.e. parent of parent of parent ...)
 - The "main" ancestor of a greenlet doesn't change once it has stack frames
 - The "main" ancestor of an executing greenlet is the "main" greenlet of the thread
- Enforcement
 - Parents of "main" greenlets are always null
 - When a parent of a user greenlet is changed, a search for a "main" ancestor is done
 - Includes cycle detection
 - If mutating a greenlet that has stack frames, the "main" ancestor must be the same as before
 - When a switch is performed, check that the "main" ancestor is the same as before

target.switch(*args, **kwargs)

- Transfers control to the target greenlet
- First time: new stack is created and target.run(args, kwargs) is called on it
- Later: the (single) argument is returned from target's last call to switch/throw

target.throw(err)

- Transfers control to the target greenlet
- First time: kills target and performs target.parent.throw(err)
- Later: the argument is thrown from target's last call to switch/throw

Finishing and Dead Greenlets

- When a user greenlet's run function finishes executing
 - If it returns a value, then `parent.switch` is performed with that value as the argument
 - If it throws an error, then `parent.throw` is performed with that error
 - Unless the error is a `GreenletExit`, in which case `parent.switch` is performed with the error
 - The current greenlet is now dead
- If a dead greenlet is switched/thrown to
 - The switch/throw is forwarded to its parent
- Before an unfinished greenlet is garbage collected, `unfinished.throw(new GreenletExit)` is performed

Brainstorming

How can we support greenlets in WebAssembly?