Cooperative and Forced Termination

See also

Asynchronous Exceptions in Haskell
Marlow, Peyton Jones, Moran and Reppy
PLDI, 2001
Cooperative vs. Forced Termination

Cooperative termination: ask a process to clean itself up and exit

- `Thread.interrupt()`
- `Ctrl-C` or `kill`
- `break-thread`

Forced termination: stop a process immediately

- `Thread.stop()`
- `kill -9`
- `kill-thread`
- `custodian-shutdown-all`
Cooperative Termination in Java

• When a Java thread is interrupted with `Thread.interrupt()`, then `Object.wait()`, `Thread.join()`, or `Thread.sleep()` raises `InterruptedException`

```java
class Worker implements Runnable {
    public void run() {
        try {
            while(...) {
                ... Thread.currentThread().sleep()
                ... 
            }
        } catch (InterruptedException e) { ... }
    }
}
```

Is `Thread.sleep()` (or one of the other methods) called often enough?
Cooperative Termination in MzScheme

`break-thread` immediately raises an asynchronous exception in the target thread — unless breaks are disabled.

`parameterize-break` enables/disables breaks.

Breaks are implicitly disabled in certain clean-up contexts:

- Queue example: works fine due to NACKs.
- Swap-channel example: need to use `wrap-evt` instead of `handle-evt`.
- Initial setup: tedious, but easily abstracted to `thread/breakable`.
- Code that allocates a resource: tedious!
Cooperative Termination Successes

Using Ctl-C to interrupt compilation

• Cleans up half-written files before exiting

Using Ctl-C to interrupt scripts

• Default handler prints stack trace
Cooperative Termination Failures

Interrupting DrScheme's Help browser:

- Initially used cooperative termination
- Quickly found to be buggy (after a few days)
- Somewhat quickly found to be still buggy (after a few months)
- Slowly found to be actually quite buggy, still (after a few years)
- Slowly found to be hopelessly buggy (after a few years more)
- Finally converted forced termination
  - and we've never encountered a bug since

Interrupting a package build:

- Initially written using cooperative termination
- Buggy code immediately converted forced termination