Different ways to get memory consumption or lessons learned from ``memory_profiler``

As part of the development of memory_profiler I've tried several ways to get memory usage of a program from within Python. In this post I'll describe the different alternatives I've tested.

The psutil library

psutil is a python library that provides an interface for retrieving information on running processes. It provides convenient, fast and cross-platform functions to access the memory usage of a Python module:

```
def memory_usage_psutil():
    # return the memory usage in MB
    import psutil
    process = psutil.Process(os.getpid())
    mem = process.get_memory_info()[0] / float(2 ** 20)
    return mem
```

The above function returns the memory usage of the current Python process in MiB. Depending on the platform it will choose the most accurate and fastest way

to get this information. For example, in Windows it will use the C++ Win32 API while in Linux it will read from `/proc`, hiding the implementation details and proving on each platform a fast and accurate measurement.

If you are looking for an easy way to get the memory consumption within Python this in my opinion your best shot.

The resource module

The resource module is part of the standard Python library. It's basically a wrapper around getrusage, which is a POSIX standard but some methods are still missing in Linux . However, the ones we are interested seem to work fine in Ubuntu 10.04. You can get the memory usage with this function:

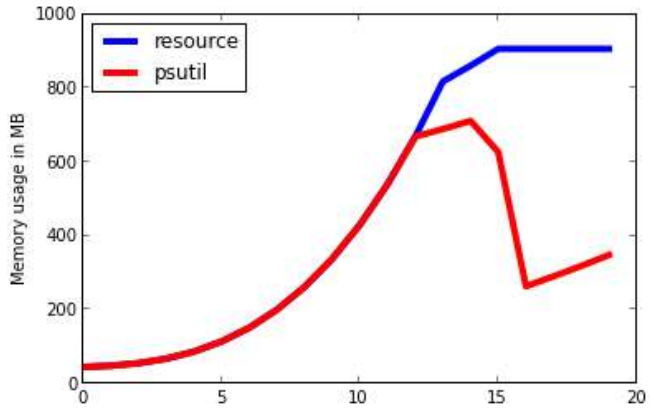
```
def memory_usage_resource():
    import resource
    rusage_denom = 1024.
    if sys.platform == 'darwin':
        # ... it seems that in OSX the output is different units ...
        rusage_denom = rusage_denom * rusage_denom
    mem = resource.getrusage(resource.RUSAGE_SELF).ru_maxrss / rusage_denom
    return mem
```

In my experience this approach is several times faster than the one based in psutil as was the default way to get the memory usage that I used in `memory_profiler` from version 0.23 up to 0.26. I changed

this behavior in 0.27 after a bug report by Philippe Gervais. The problem with this approach is that it seems to report results that are slightly different in some cases. Notably it seems to differ when objects have been recently liberated from the python interpreter.

In the following example, orphaned arrays are liberated by the python interpreter, which is correctly seen by `psutil` but not by `resource`:

```
mem_resource = []
mem_psutil = []
for i in range(1, 21):
    a = np.zeros((1000 * i, 100 * i))
    mem_resource.append(memory_usage_resource())
    mem_psutil.append(memory_usage_psutil())
```



By the way I would be delighted to be corrected if I'm doing something wrong or informed of a workaround if this exists (I've got the code to reproduce the figures [1])

querying `ps` directly

The method based on `psutils` works great but is not available by default on all Python systems. Because of this in `memory_profiler` we use as last resort something that's pretty ugly but works reasonably well when all else fails: invoking the system's `ps` command and parsing the output. The code is something like::

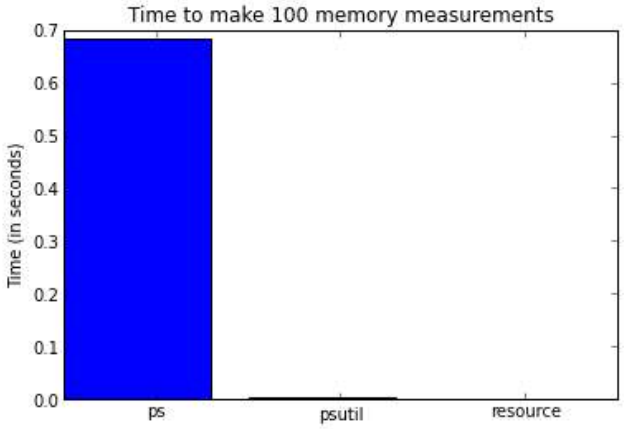
```
def memory_usage_ps():
    import subprocess
    out = subprocess.Popen(['ps', 'v', '-p', str(os.getpid())],
    stdout=subprocess.PIPE).communicate()[0].split(b'\n')
    vsz_index = out[0].split().index(b'RSS')
    mem = float(out[1].split()[vsz_index]) / 1024
    return mem
```

The main disadvantage of this approach is that it needs to fork a process for each measurement. For some tasks where you need to get memory usage very fast, like in line-by-line memory usage then this be a huge overhead on the code. For other tasks such as getting information of long-running processes, where the memory usage is anyway working on a separate process this is not too bad.

benchmarks

Here is a benchmark of the different alternatives presented above. I am plotting the time it takes the different approaches

to make 100 measurements of the memory usage (lower is better). As can be seen the smallest one is resource (although it suffers from the issues described above) followed closely by `psutil` which is in my opinion the best option if you can count on it being installed on the host system and followed far away by `ps` which is roughly a hundred times slower than `psutil`.



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1. IPython notebook to reproduce the figures: html ipynb ↩

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In psutil method, should now have:

mem = process.memory_info()[0] / float(2 ** 20)

method name was replaced in psutil

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And now should have `process.memory_full_info().uss / float(1 << 20)`, USS is "amount of memory that would become immediately available should the process terminate".

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Thanks, I've updated it.

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Just wanted to say thanks so much for writing memory_profiler! It's so useful and there's nothing else out there like it. Thanks Fabian!!!!

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Thanks! I'm glad you find this stuff useful.