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JavaOneSM

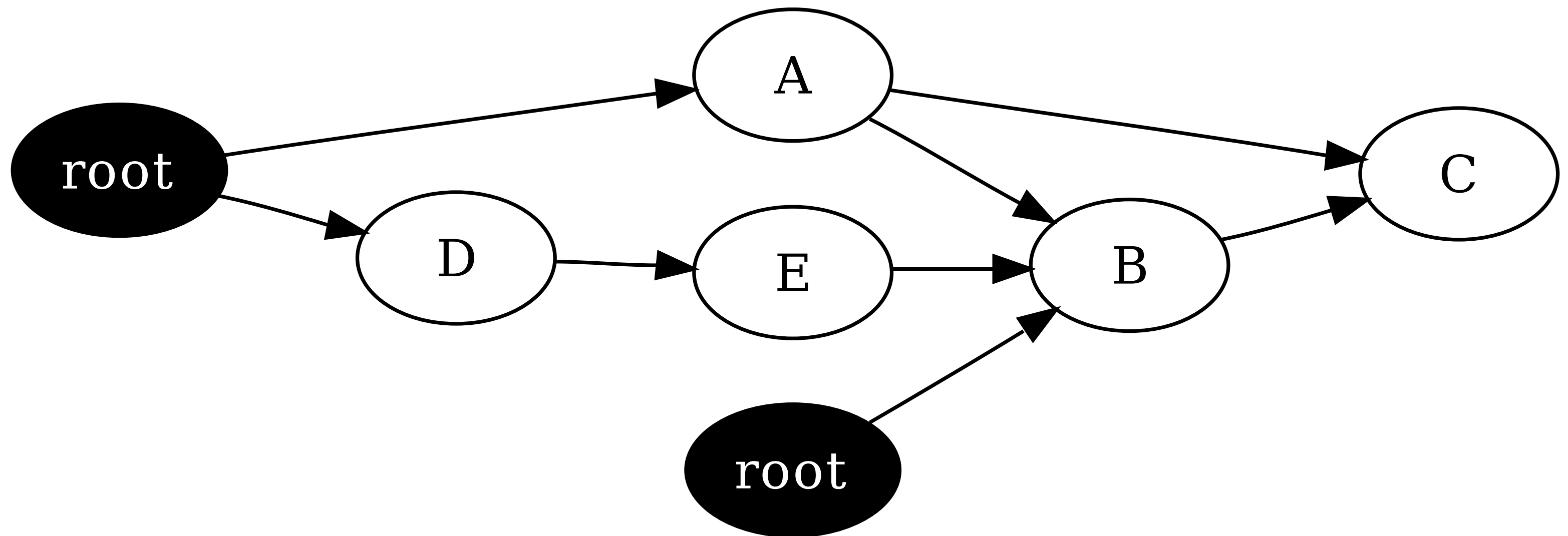
The Ghost in the Virtual Machine A Reference to References

Bob Lee
Google Inc.

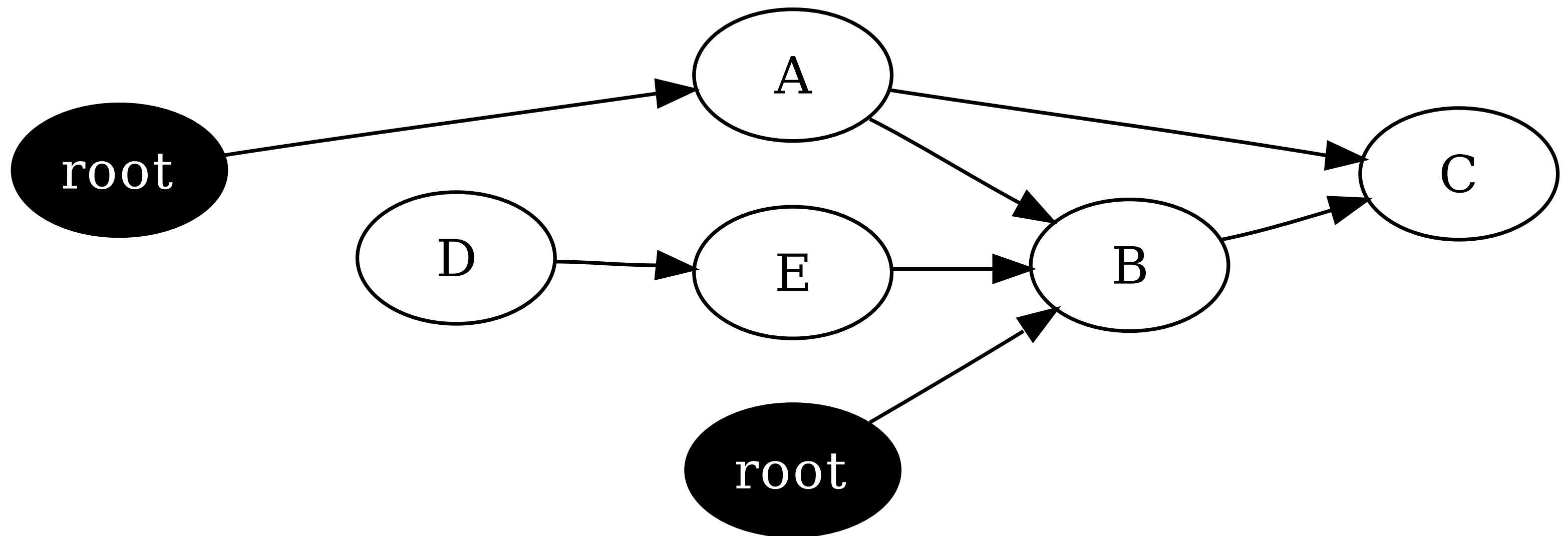
Goals

- > Take the mystery out of garbage collection.

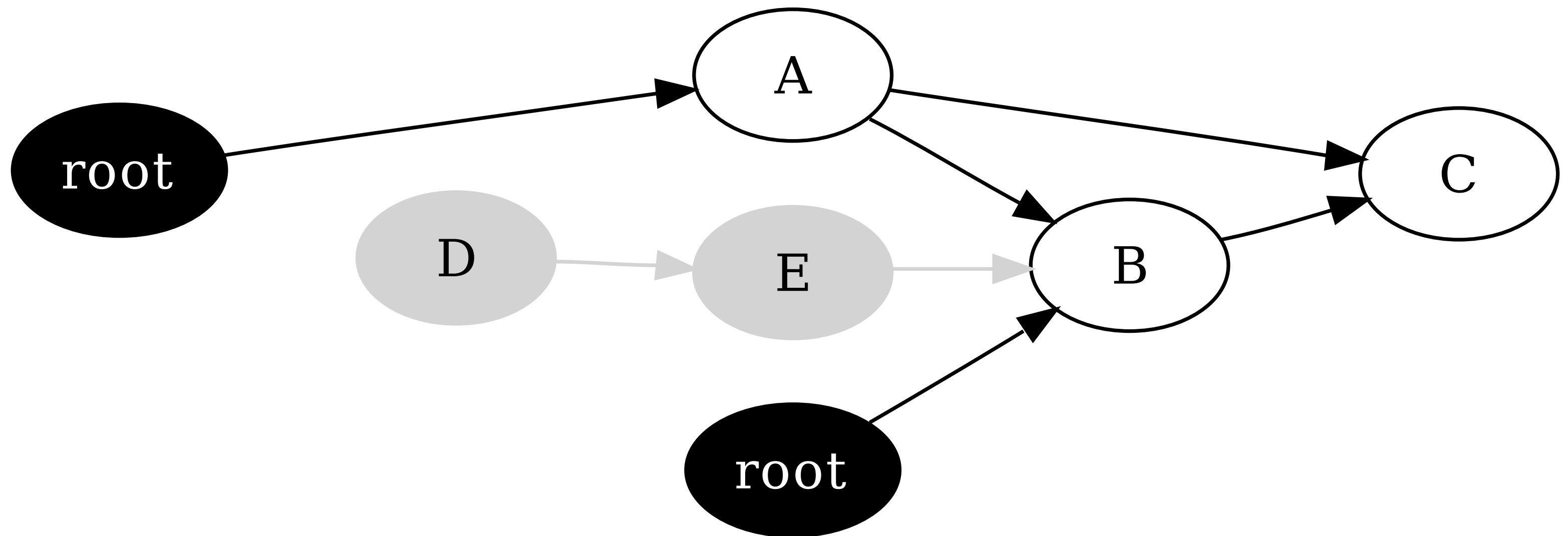
How does garbage collection work?



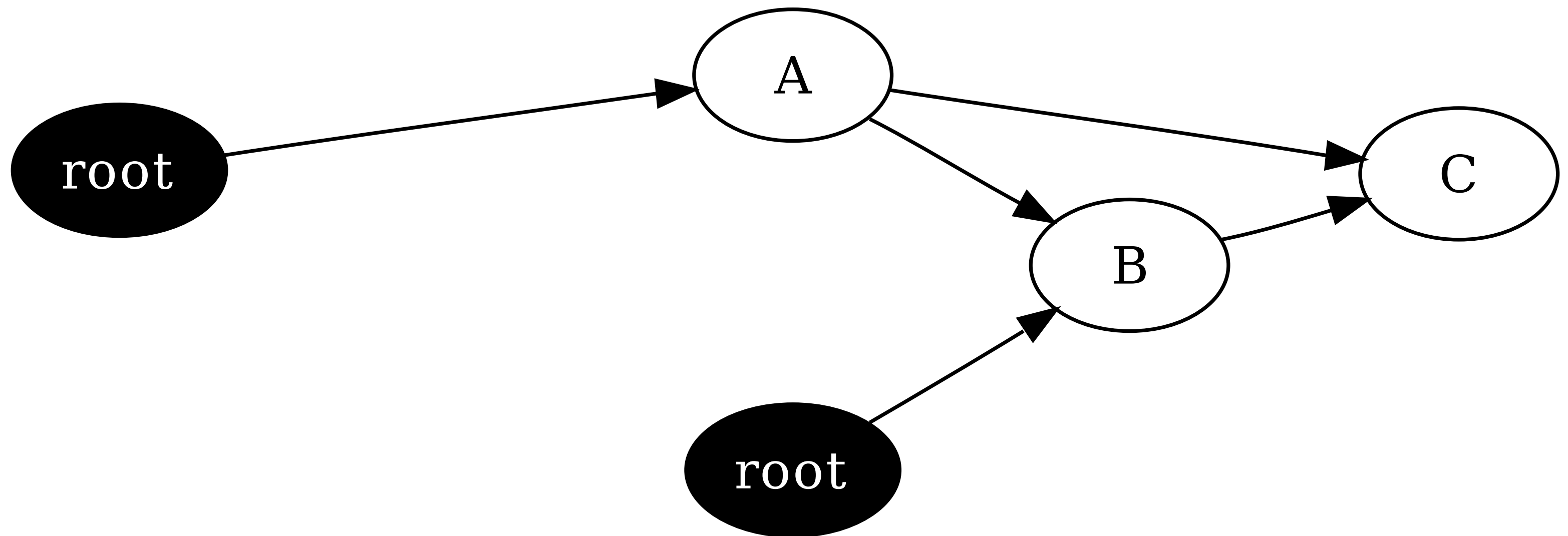
If the reference to D goes away...



We can no longer reach D or E.



So the collector reclaims them.



Reachability

- > An object is `_reachable_` if a live thread can access it.
- > Examples of heap roots:
 - System classes (which have static state)
 - Thread stacks
 - In-flight exceptions
 - JNI global references
 - The finalizer queue
 - Interned strings
 - etc. (VM-dependent)

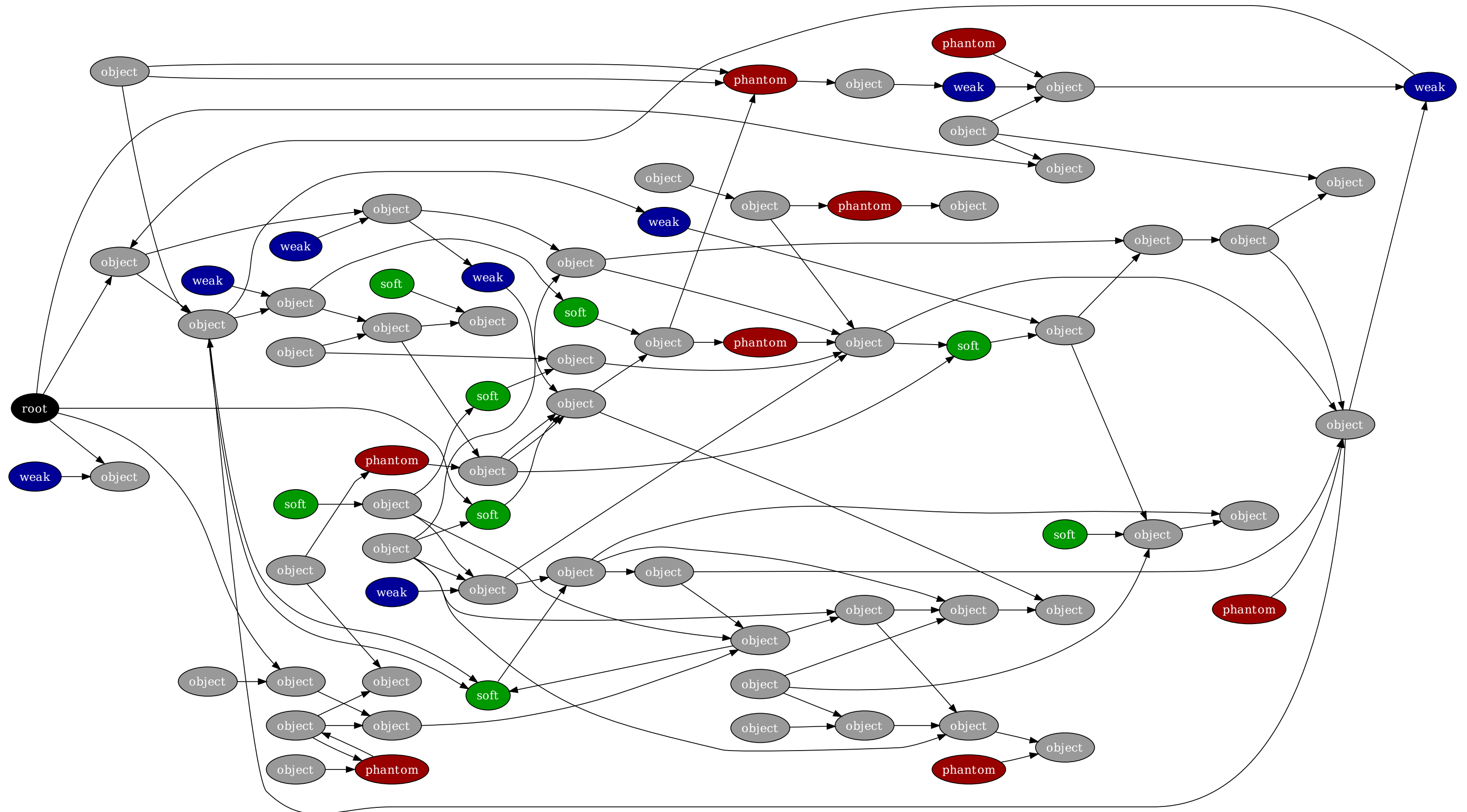
In the beginning, there was the finalizer...

```
public class Foo extends Bar {  
    @Override protected void finalize() throws Throwable {  
        try {  
            ... // Clean up Foo.  
        } finally {  
            super.finalize(); // Clean up Bar.  
        }  
    }  
}
```

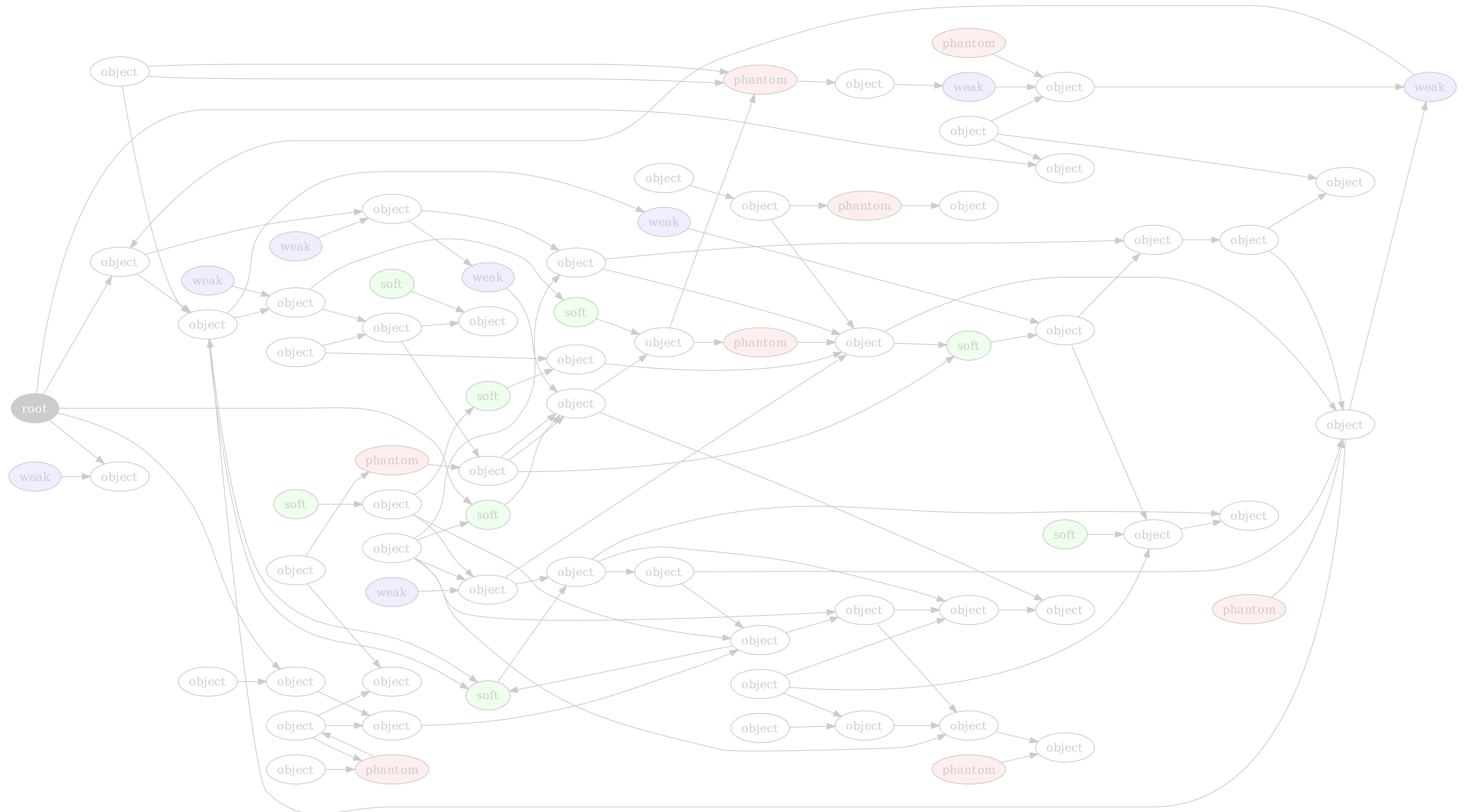

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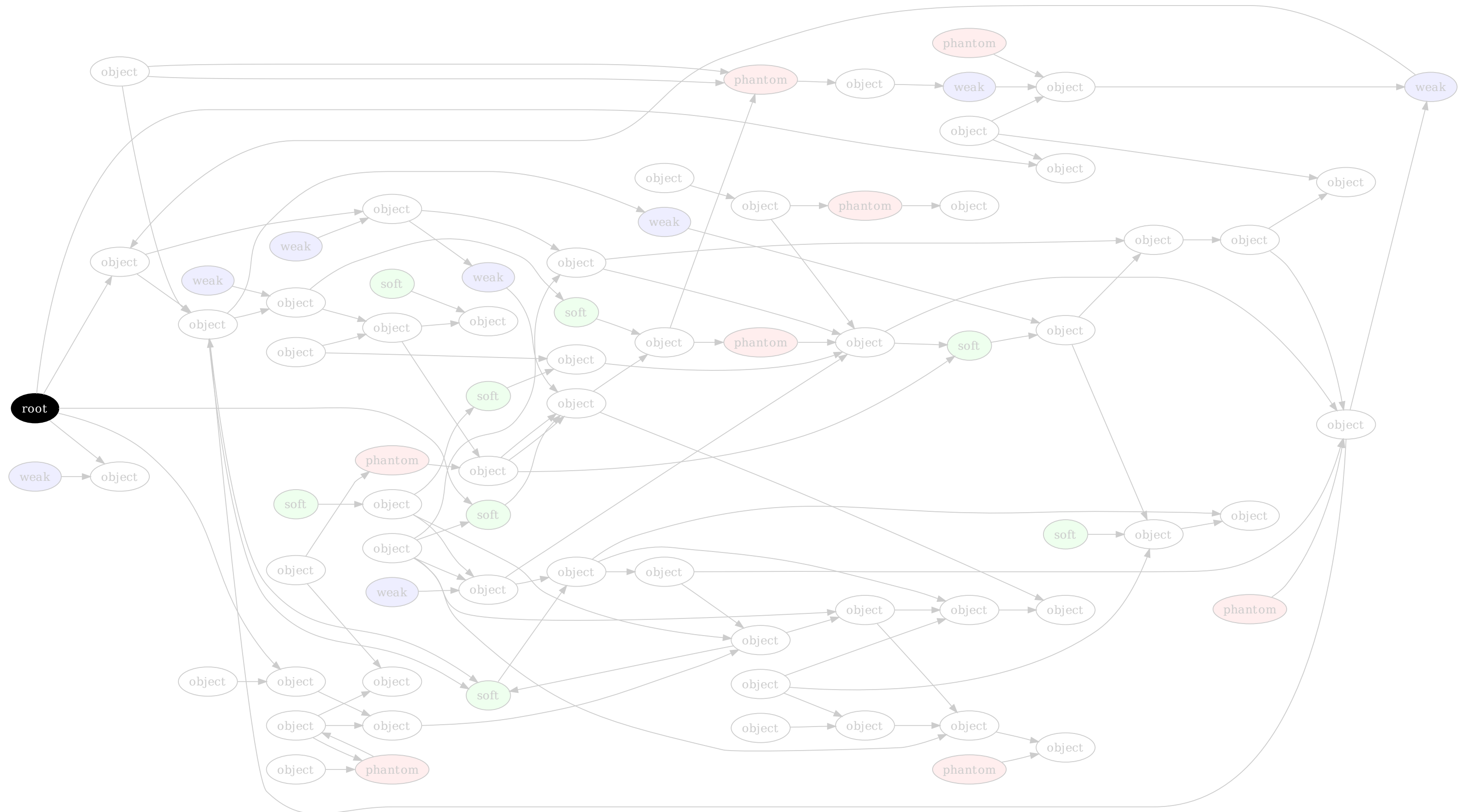
Let's mark and sweep a heap!



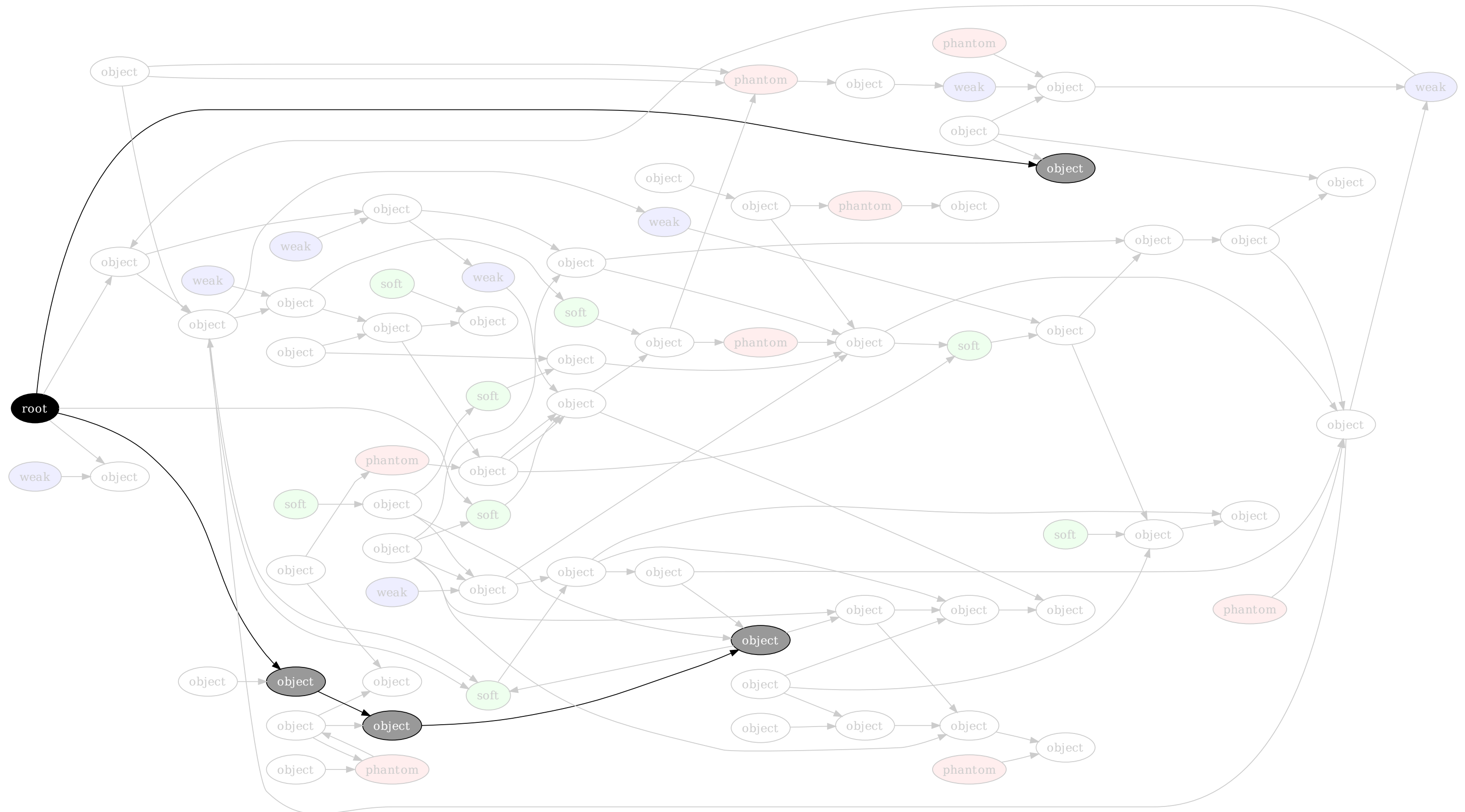
No objects are marked at first.



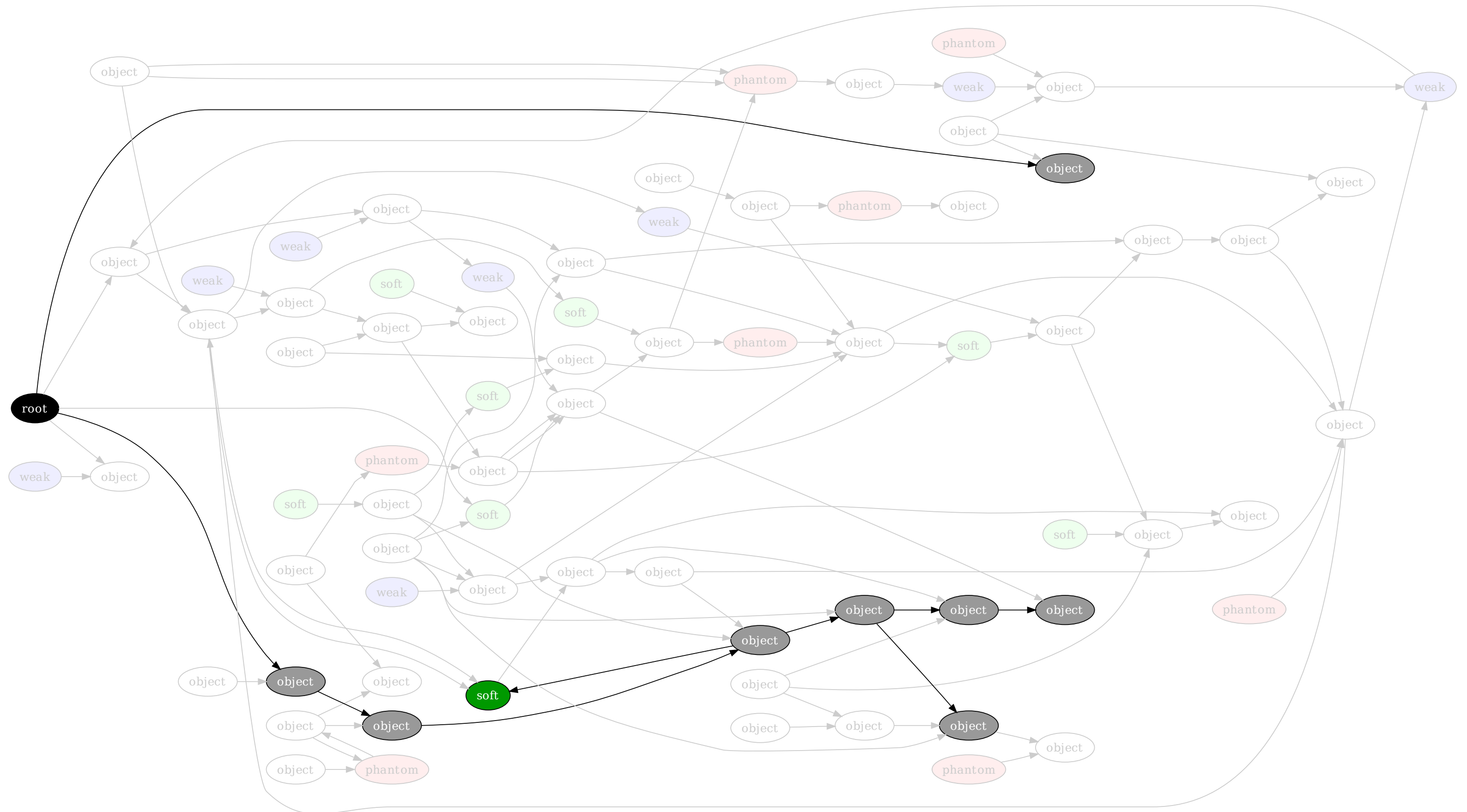
1. Start at a root.



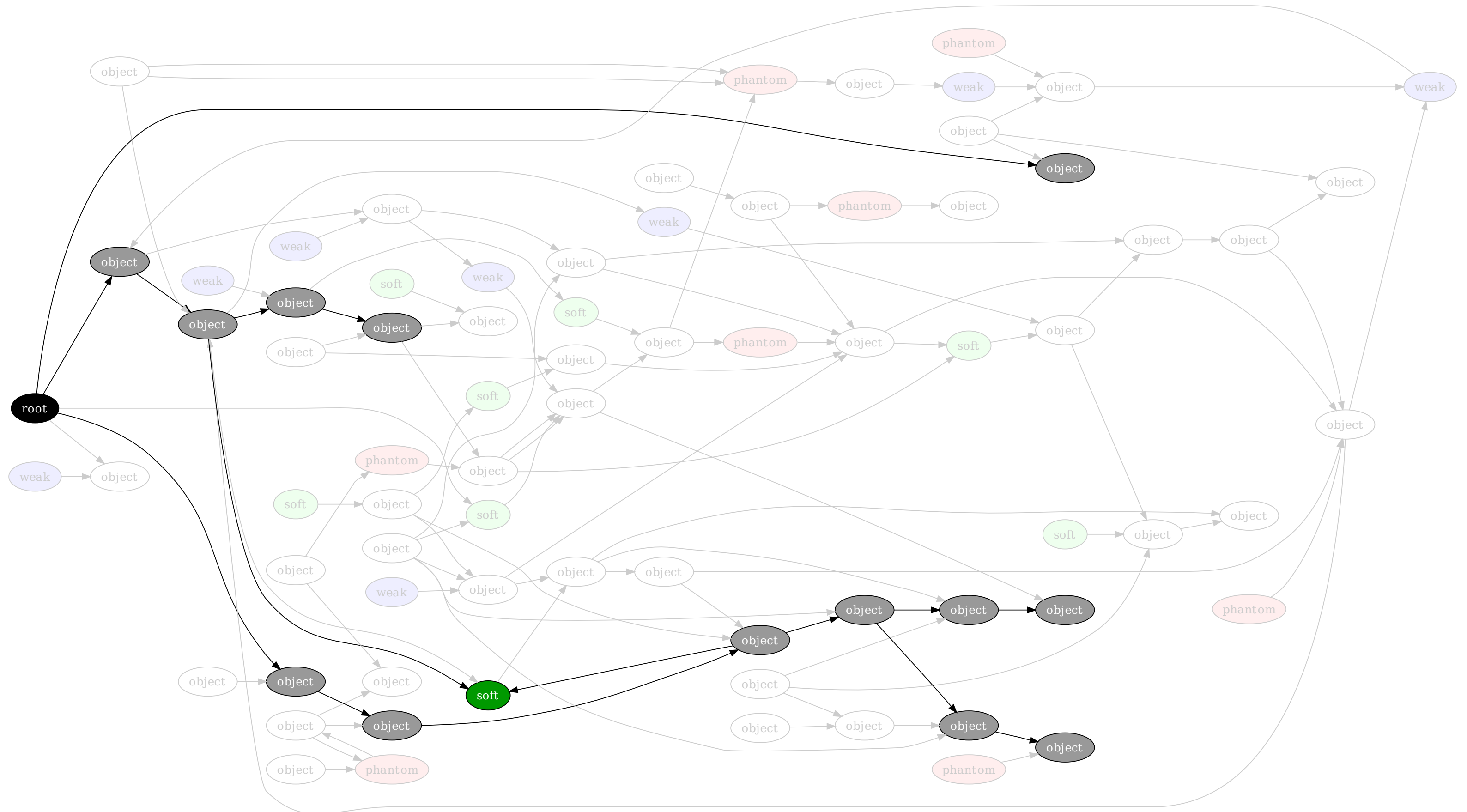
2. Trace strong references.



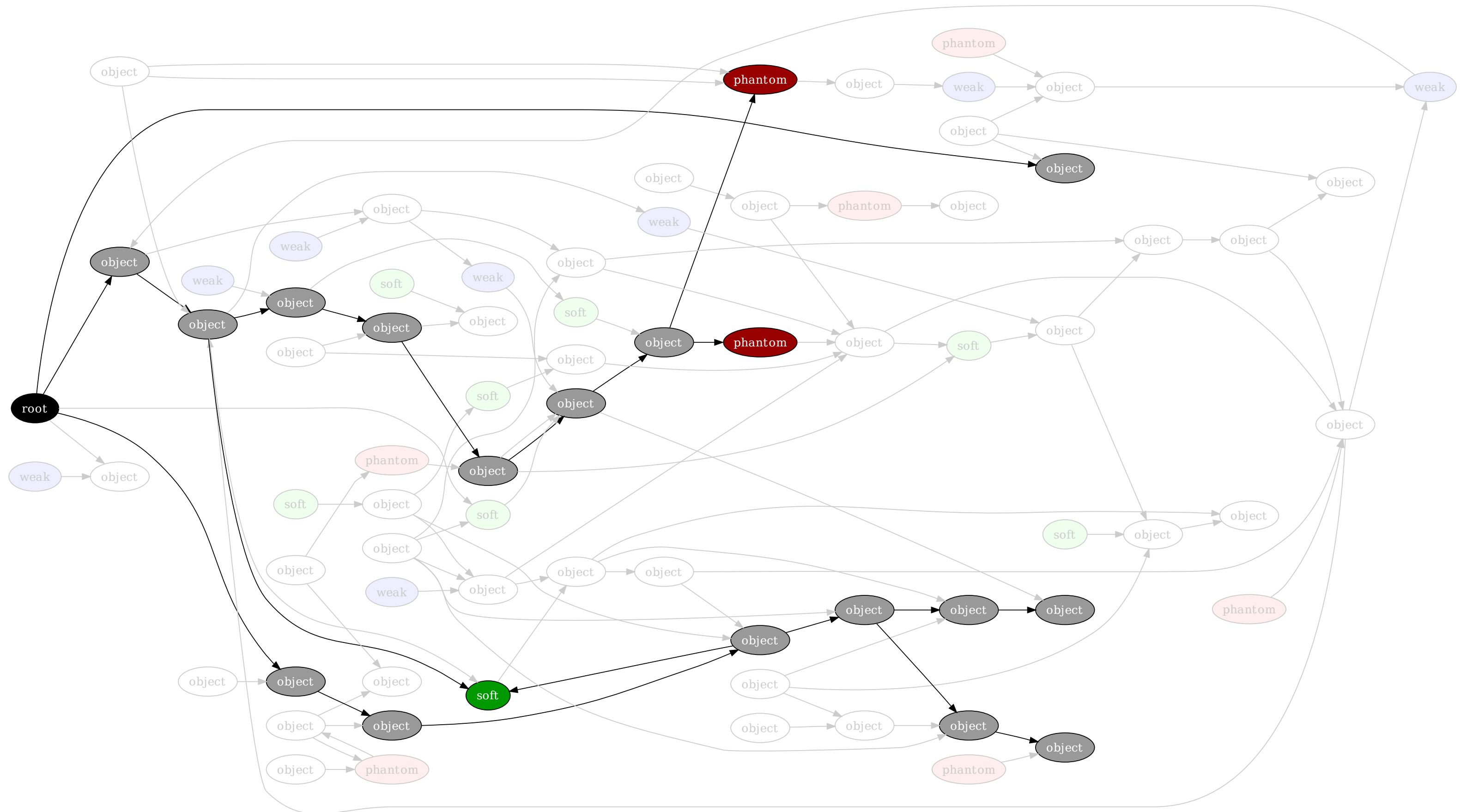
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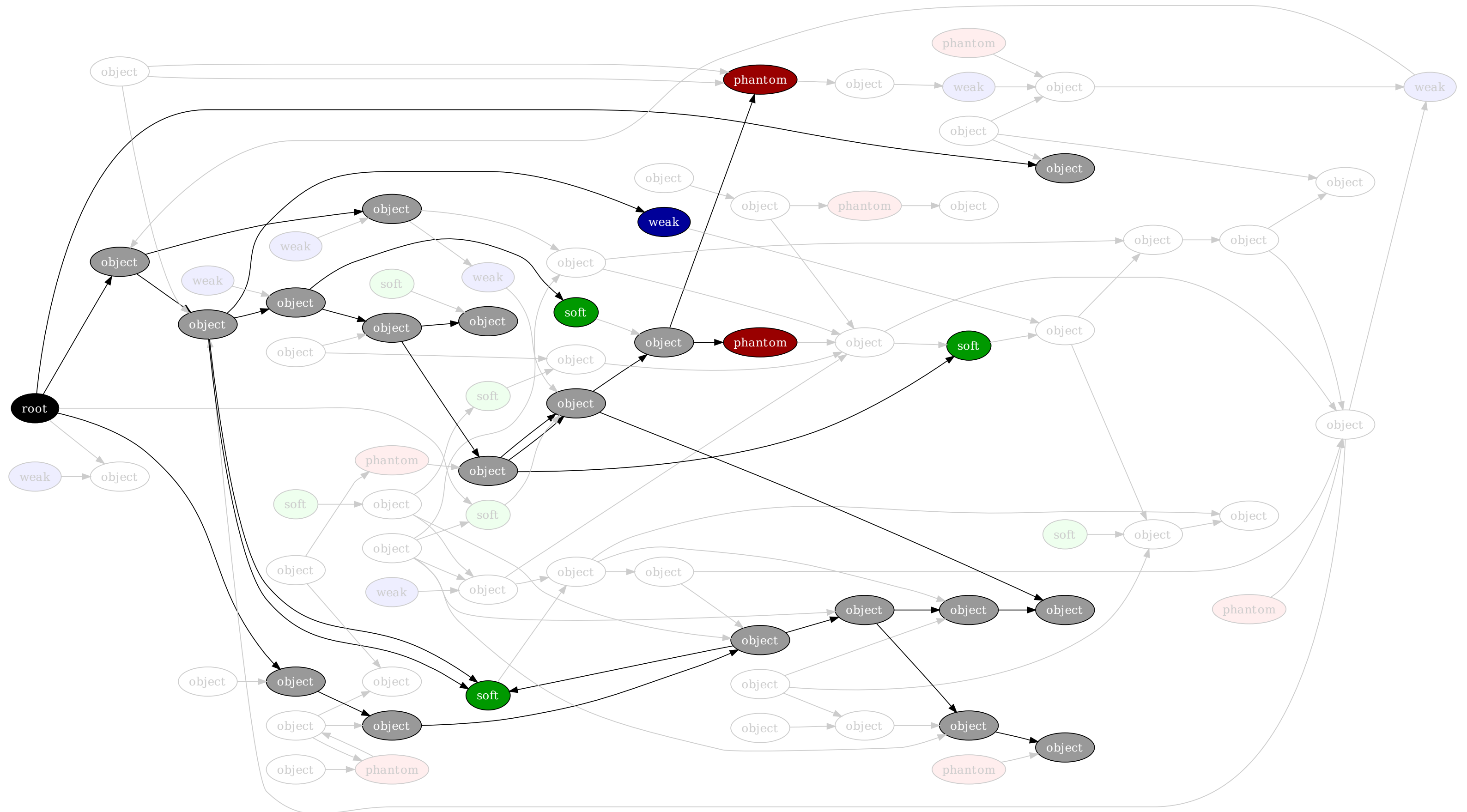
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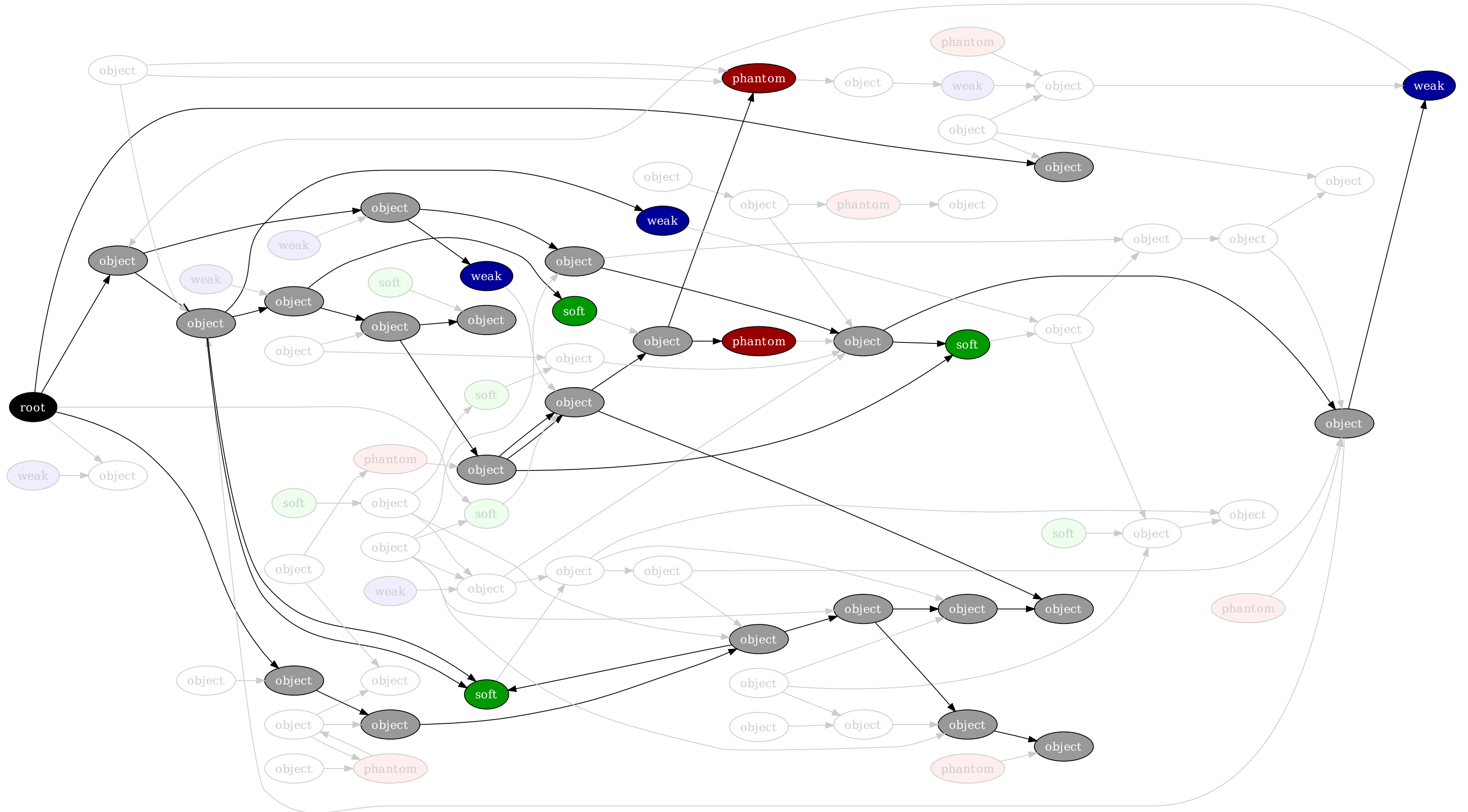
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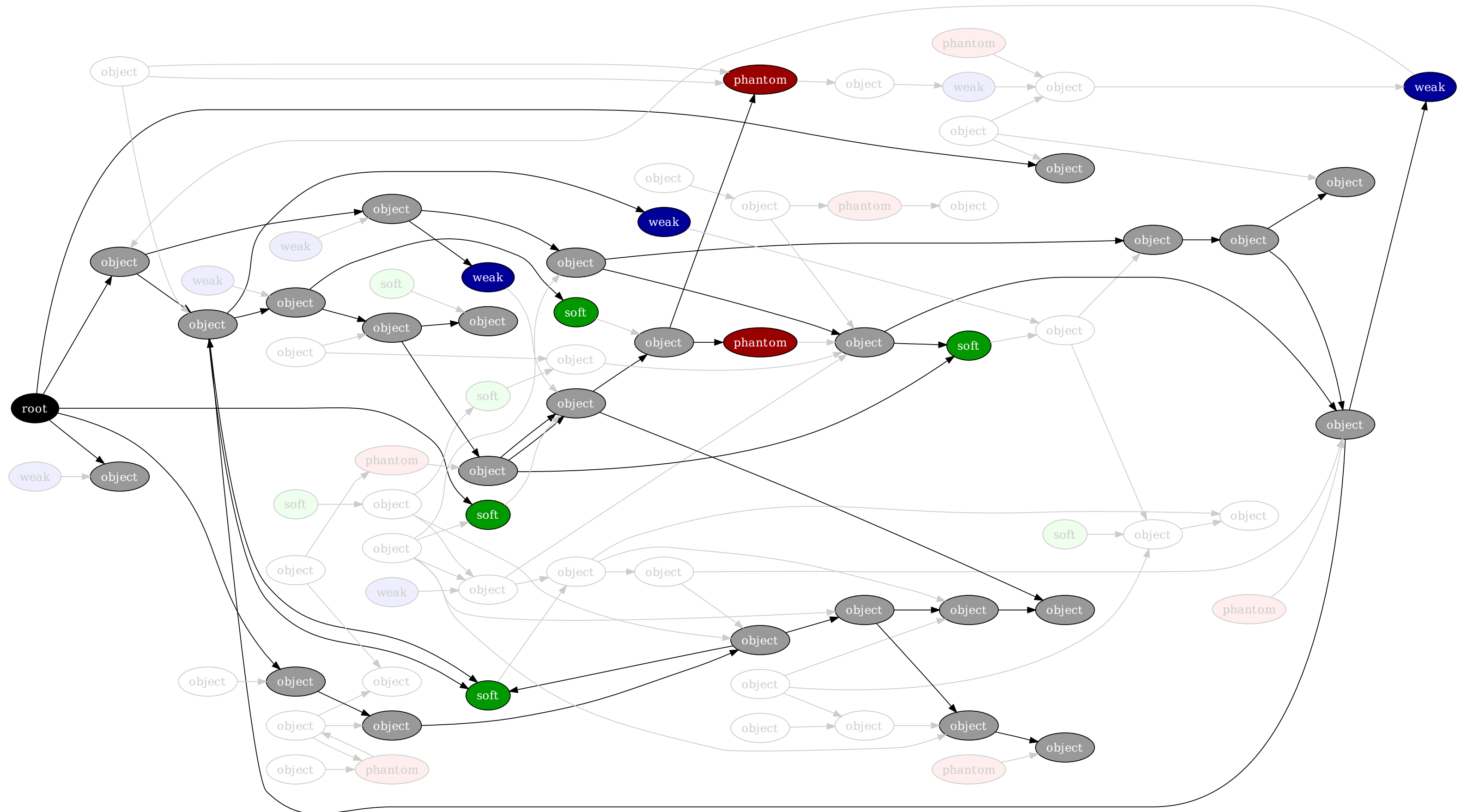
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