FACTS AND FALLACIES OF SOFTWARE ENGINEERING

By Robert L. Glass.

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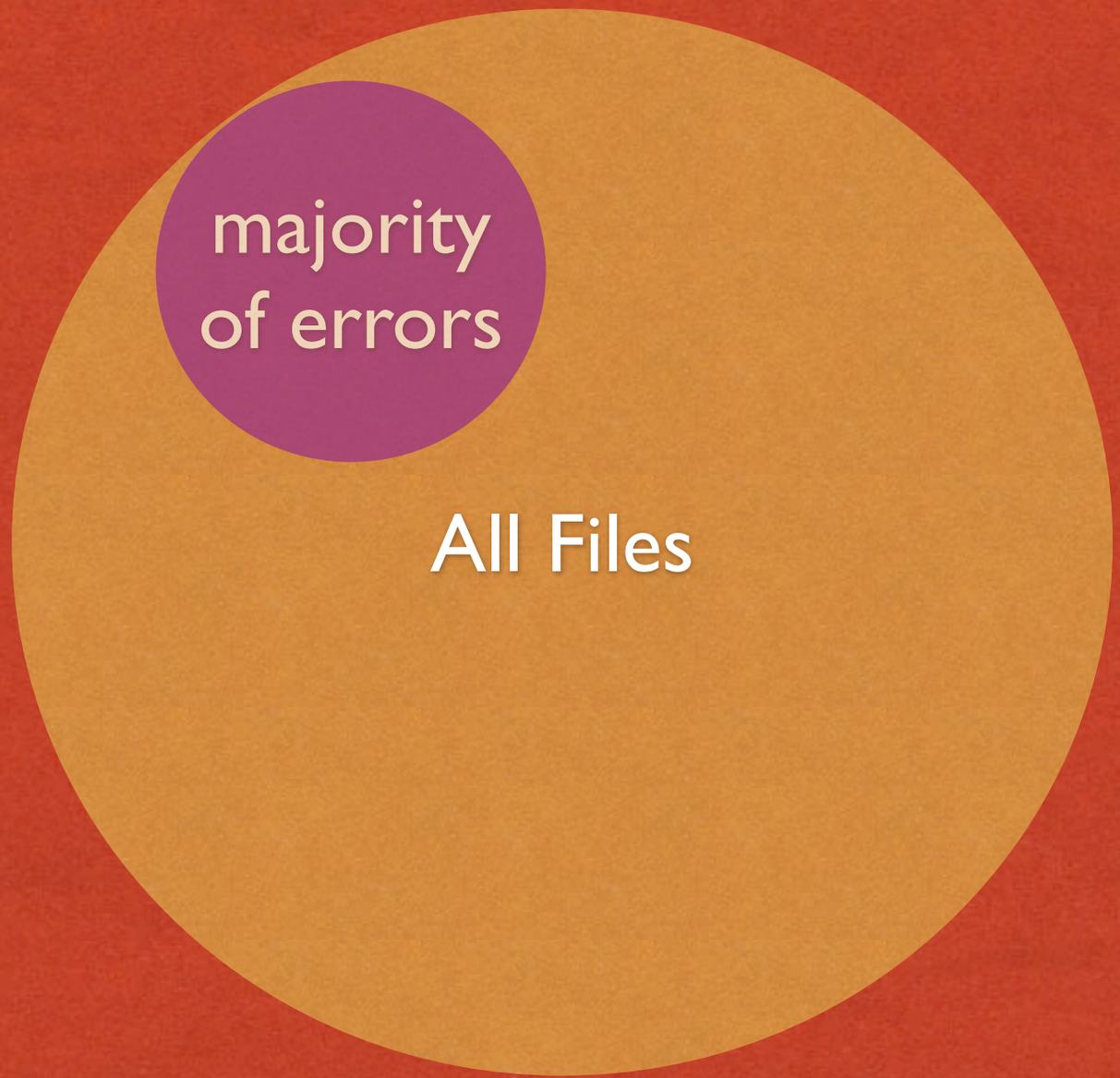
FACT 49.
Errors tend to cluster.

Cindee Madison
UC Berkeley

ERRORS TEND TO CLUSTER

- small number of files have large number of errors

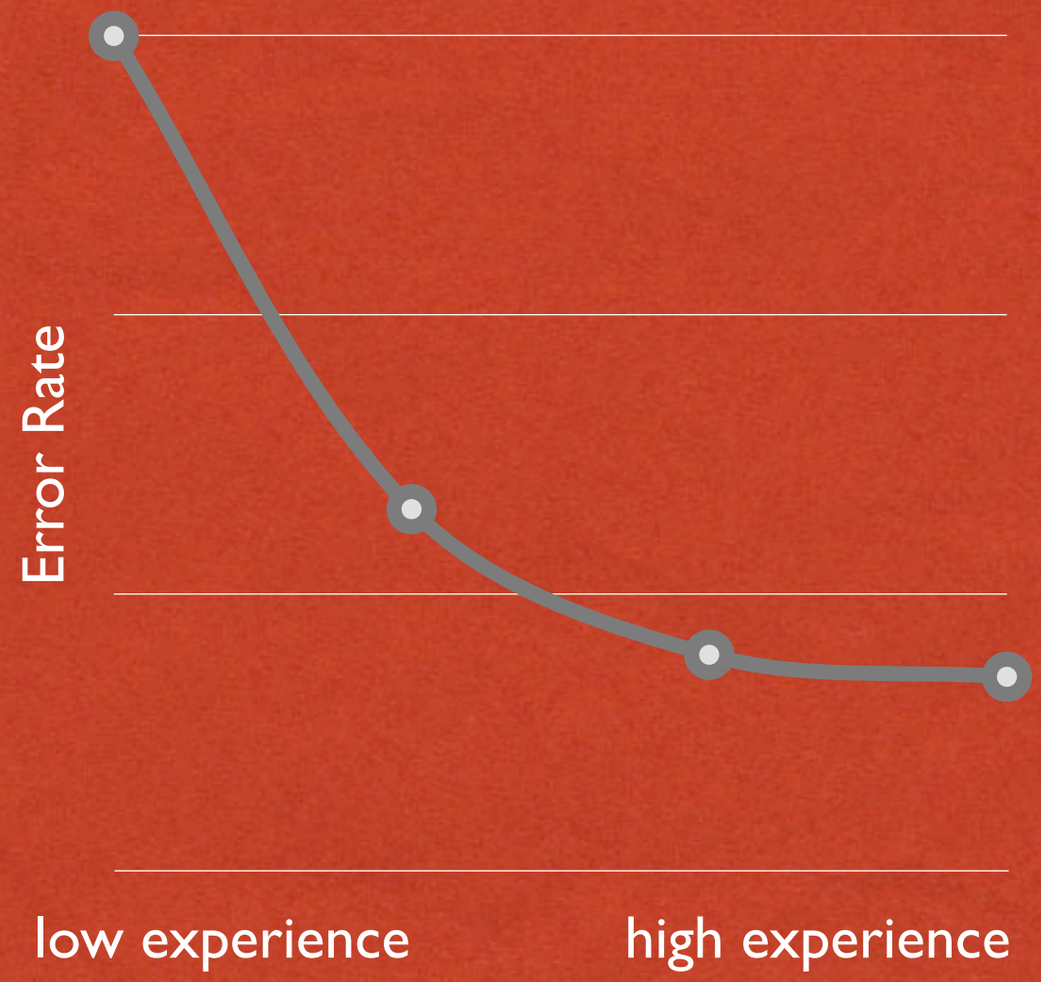
- majority of files have 0-1 error



WHY DO ERRORS CLUSTER?

Programmer inexperience with domain specific logic

Impact of Domain Specific Knowledge



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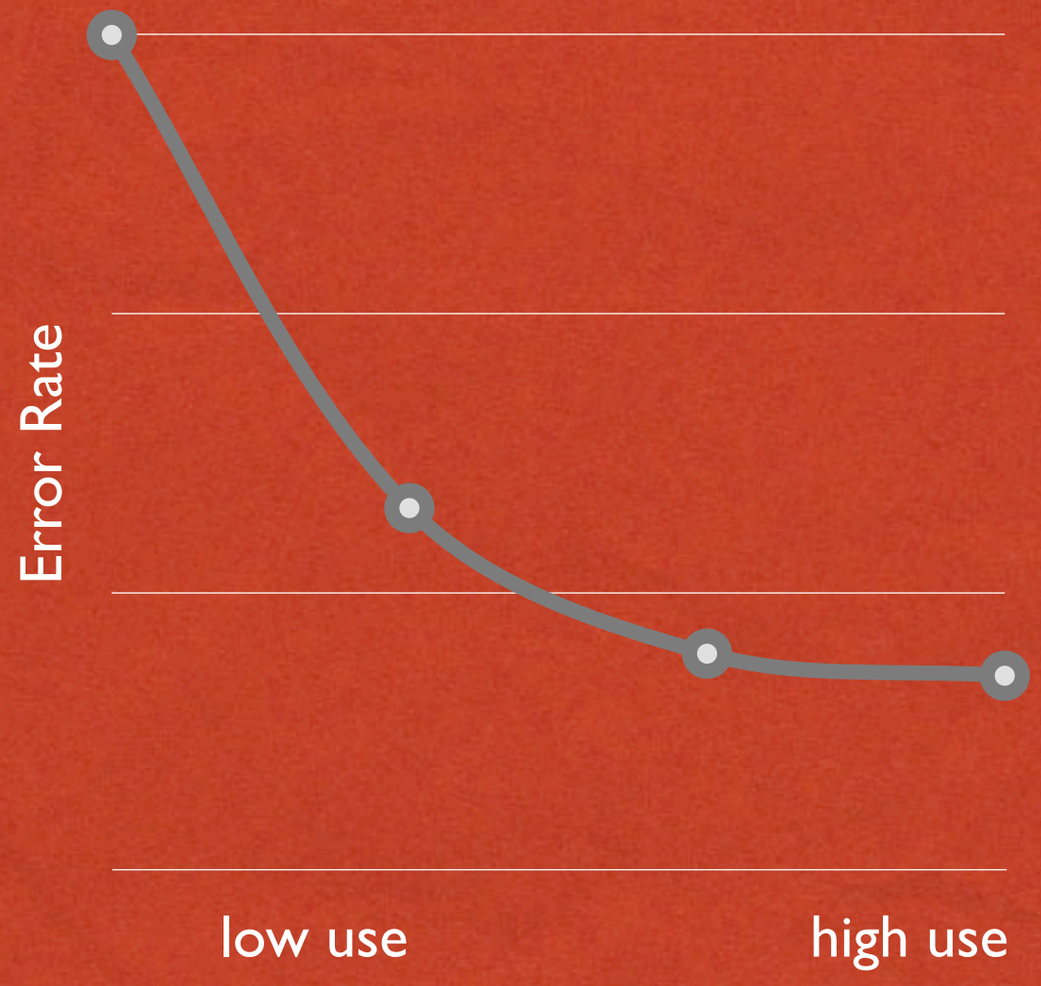
Heavily used code has fewer errors



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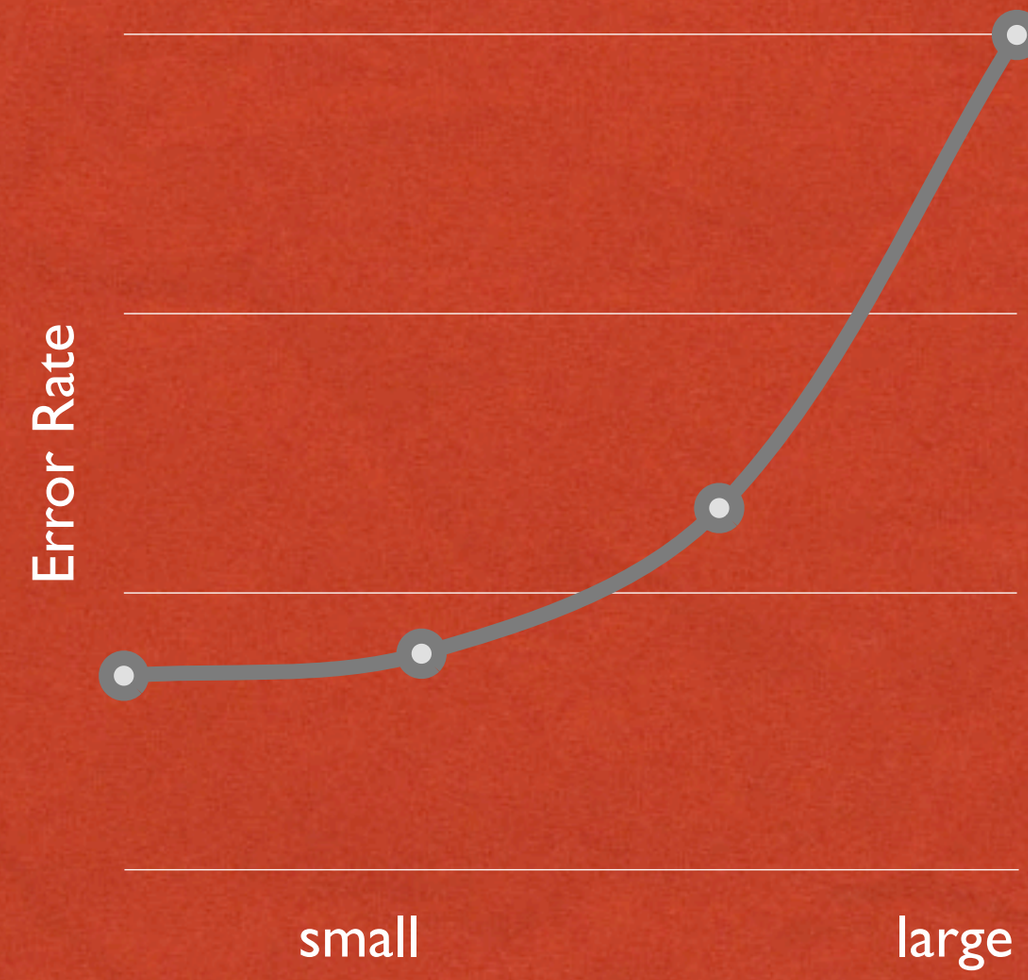
As functions grow larger the error rate increases



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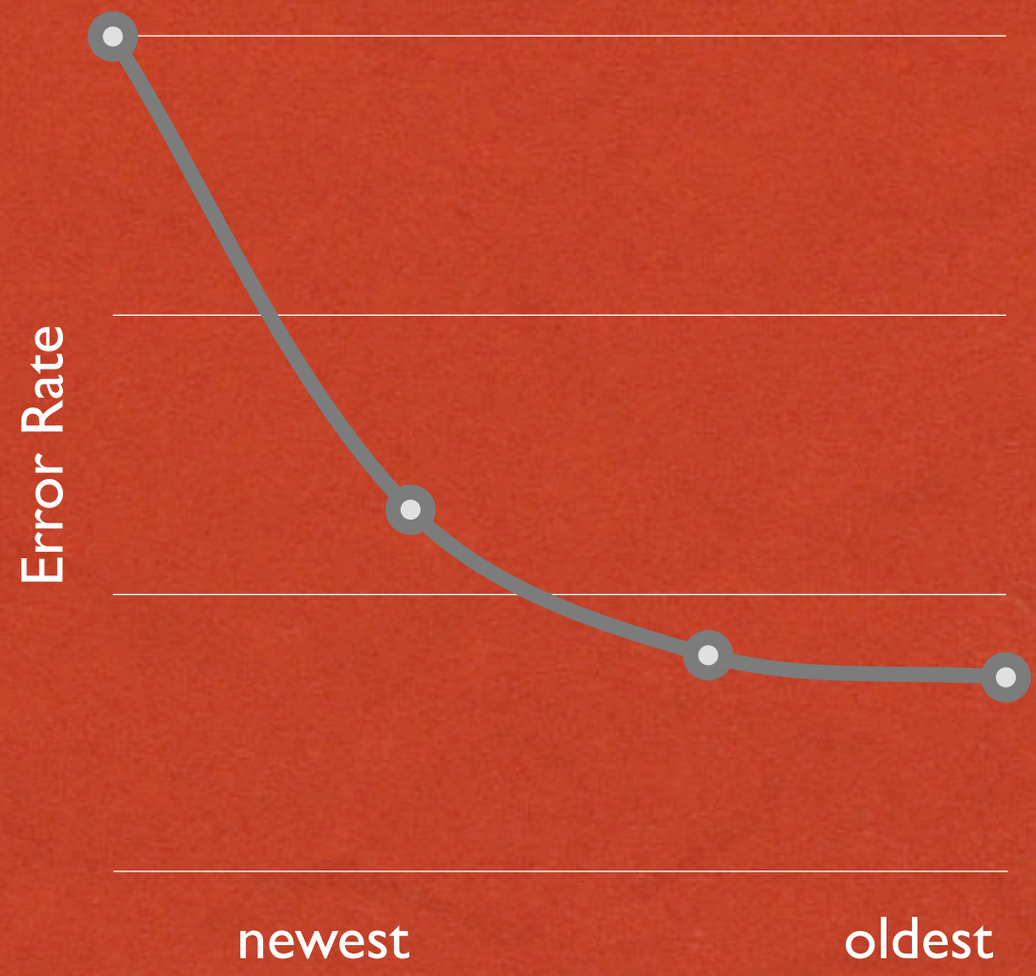
"Code Hardening"

Older files tend to have fewer errors "code hardening"

newest quartile of files has 2X errors of oldest quartile



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Primary Cause of Errors

- ignorance of interface / system rules combined with “copy and paste”
- “34 of the errors were caused by cut-and-paste: one of the errors was copied in 10 places and another in 24”

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Code Reuse Caveat

Older files have fewer errors,
However .....

- repurposing modules resulted in increased time and effort to correct errors
- Cost of developing a new implementation is less than the cost of adapting modules to a new specification

V. Basili and B. Perricone, Software Errors and Complexity: An Empirical Investigation, Communications of the ACM, vol. 27(1): 42-52, January 1984

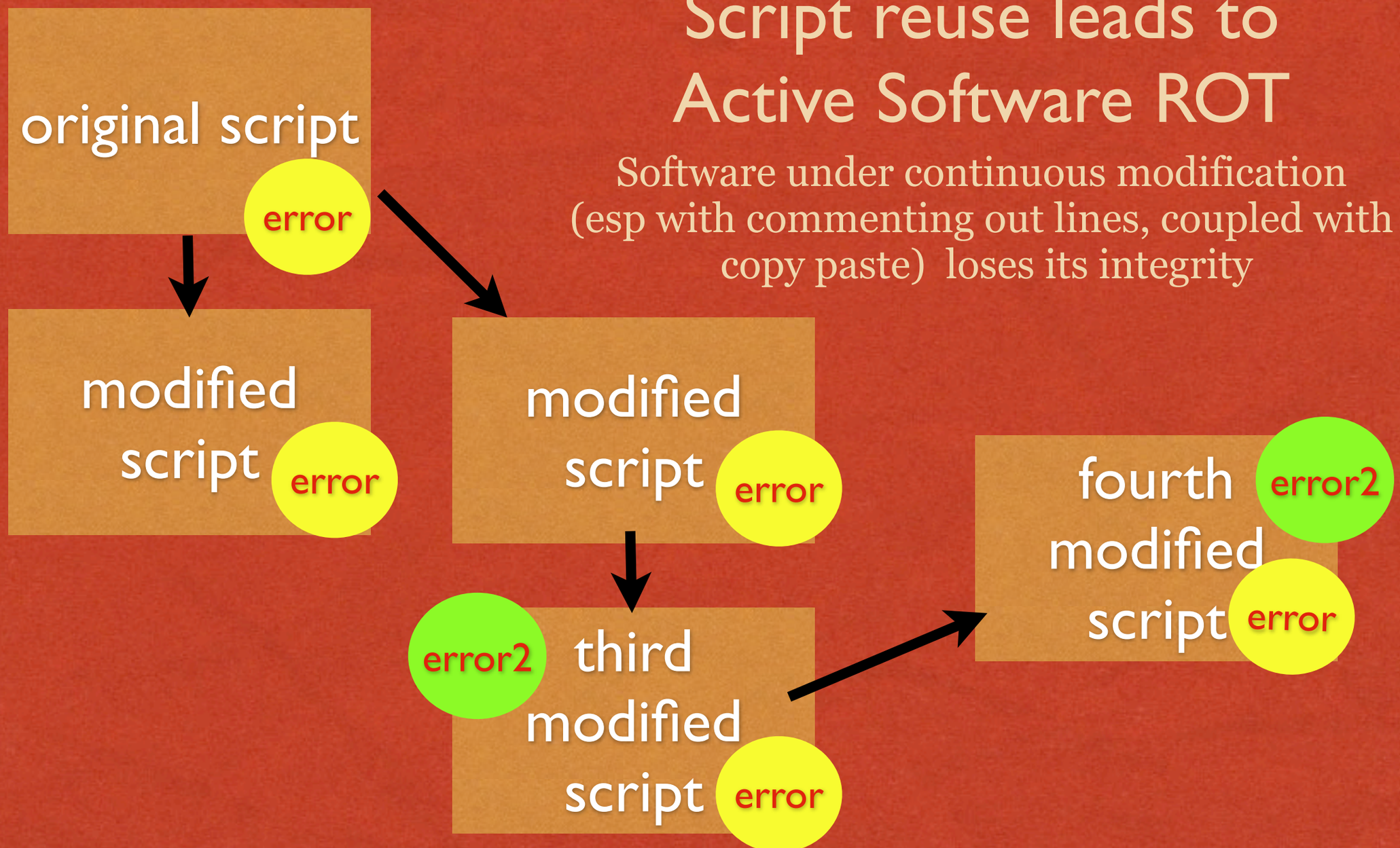
DESIGNING TO REDUCE ERRORS

- if you find more than one error, keep looking, there are likely more
- keep code modular, break complex logic into smaller parts
- increase reuse ***without*** modification
- heavily test difficult logic, or areas of weak specification understanding
- consider cost of modifying code for new specification, vs designing a new implementation

Example

Script reuse leads to Active Software ROT

Software under continuous modification (esp with commenting out lines, coupled with copy paste) loses its integrity



Example (solution?)

- create libraries of common generic logic and algorithms
  - well tested, and reviewed
  - errors fixed in library benefits all child scripts
- write new wrappers for specific implementations from scratch
- bug tracking tools (to keep all users aware of changes to library)