Visualizing the Complexity of Software Module Upgrades

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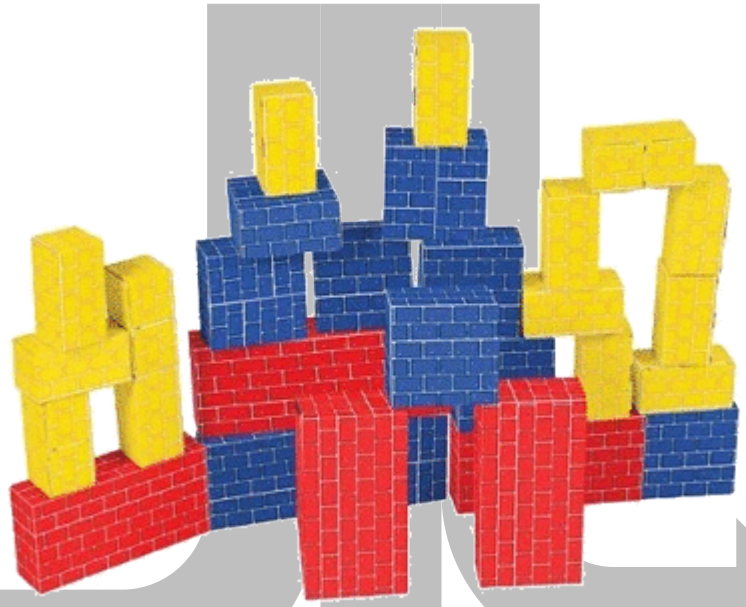
ASML

intel

tsmc

... SAMSUNG ...

ASML



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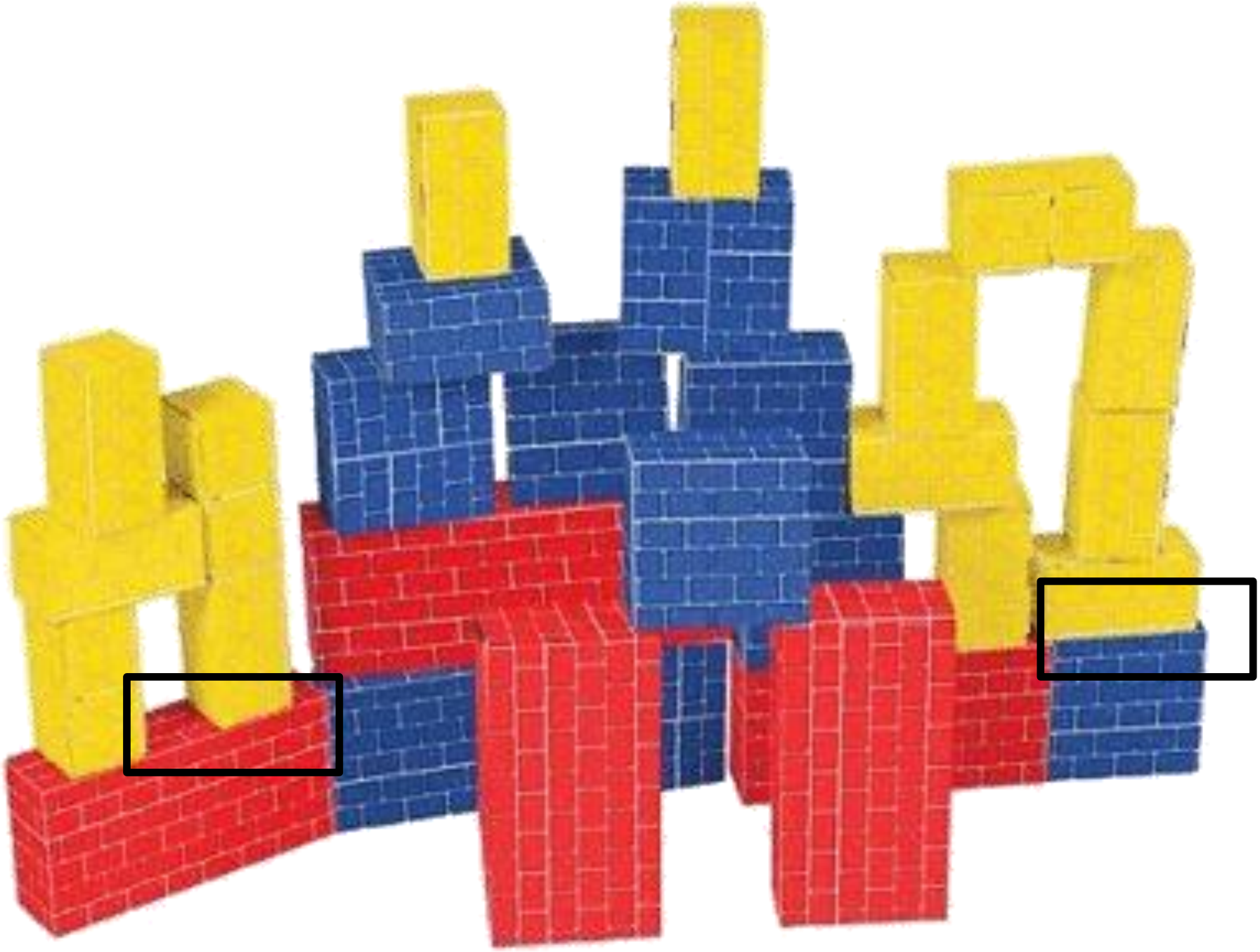
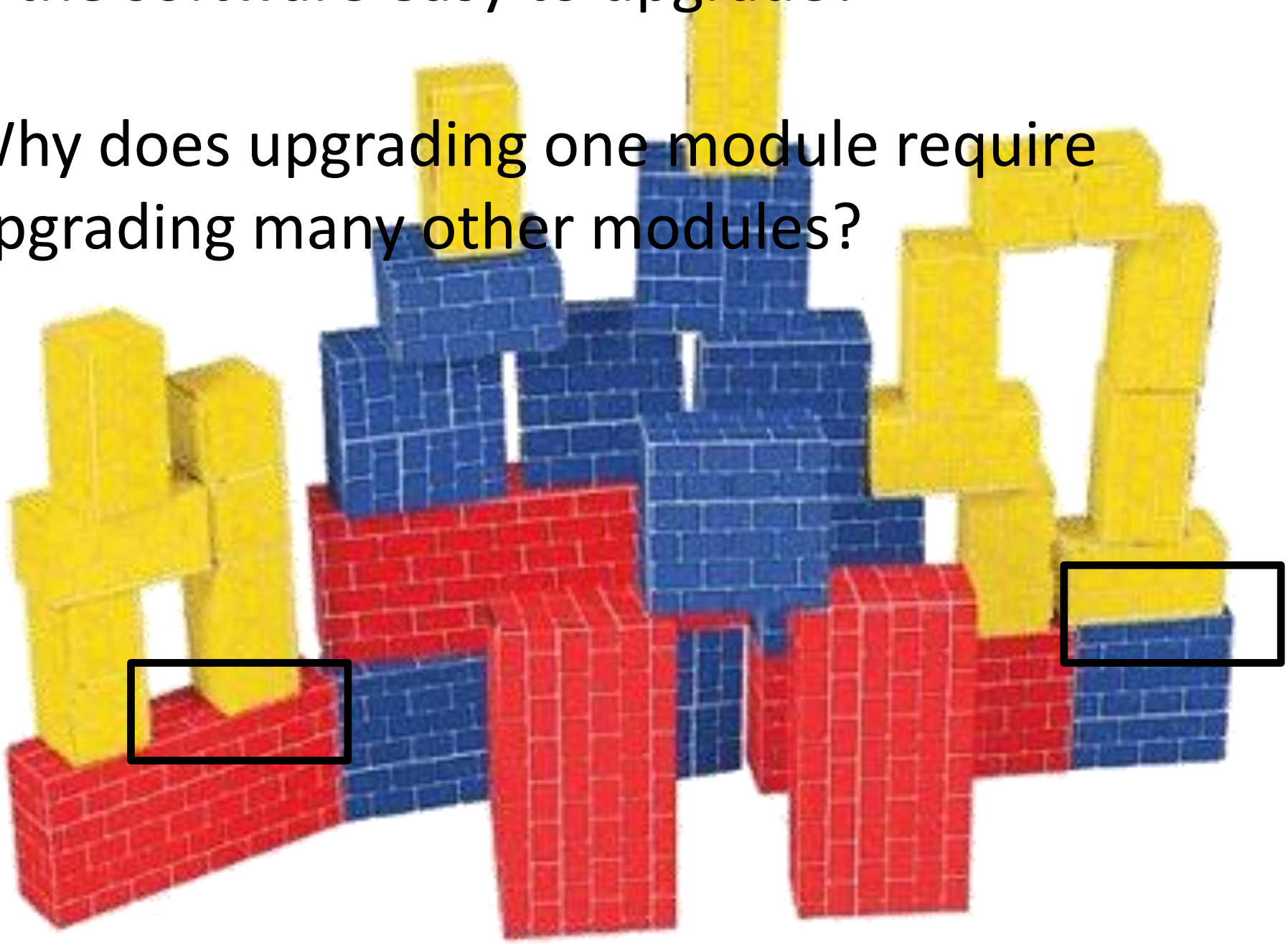
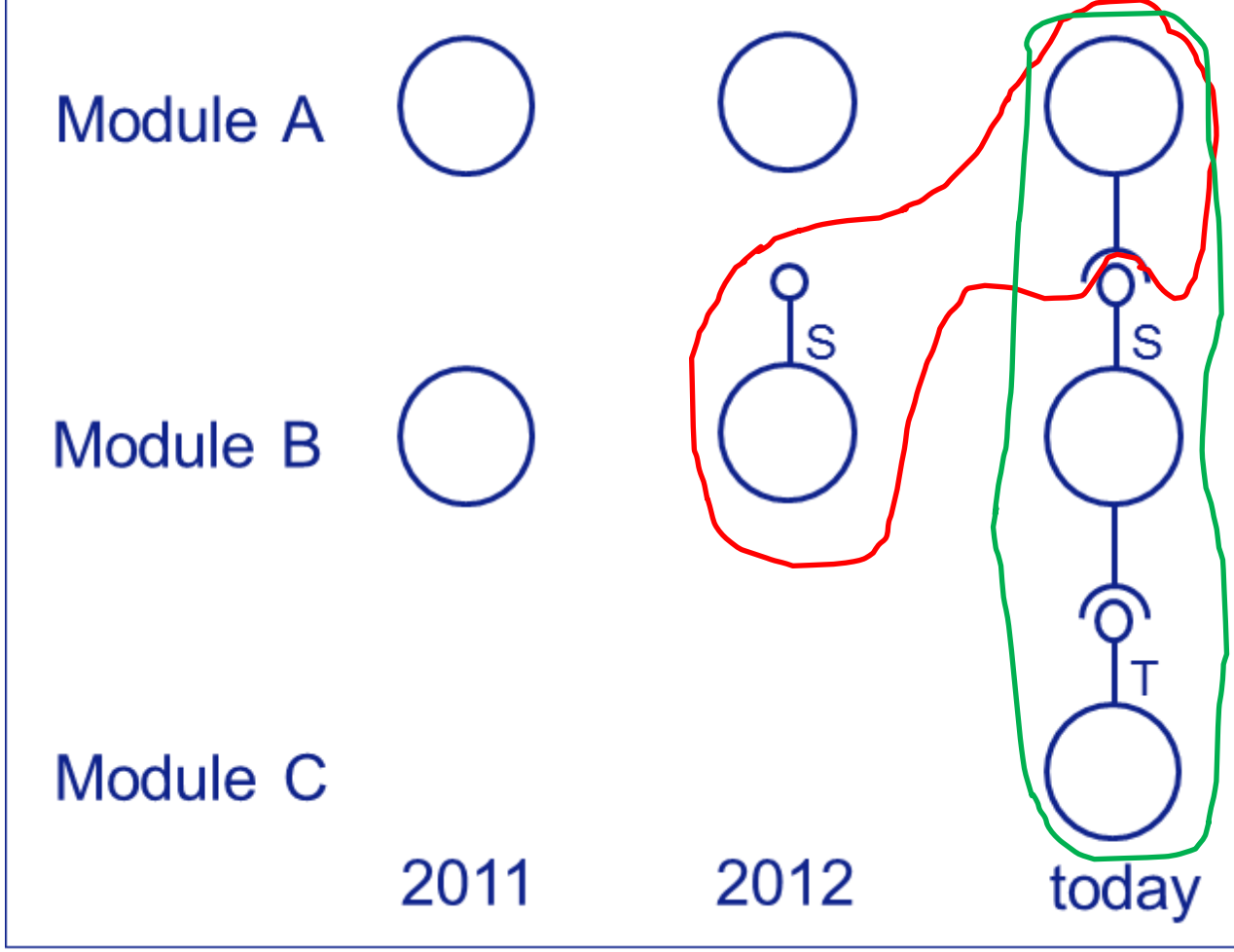


Is the software easy to upgrade?

Why does upgrading one module require upgrading many other modules?

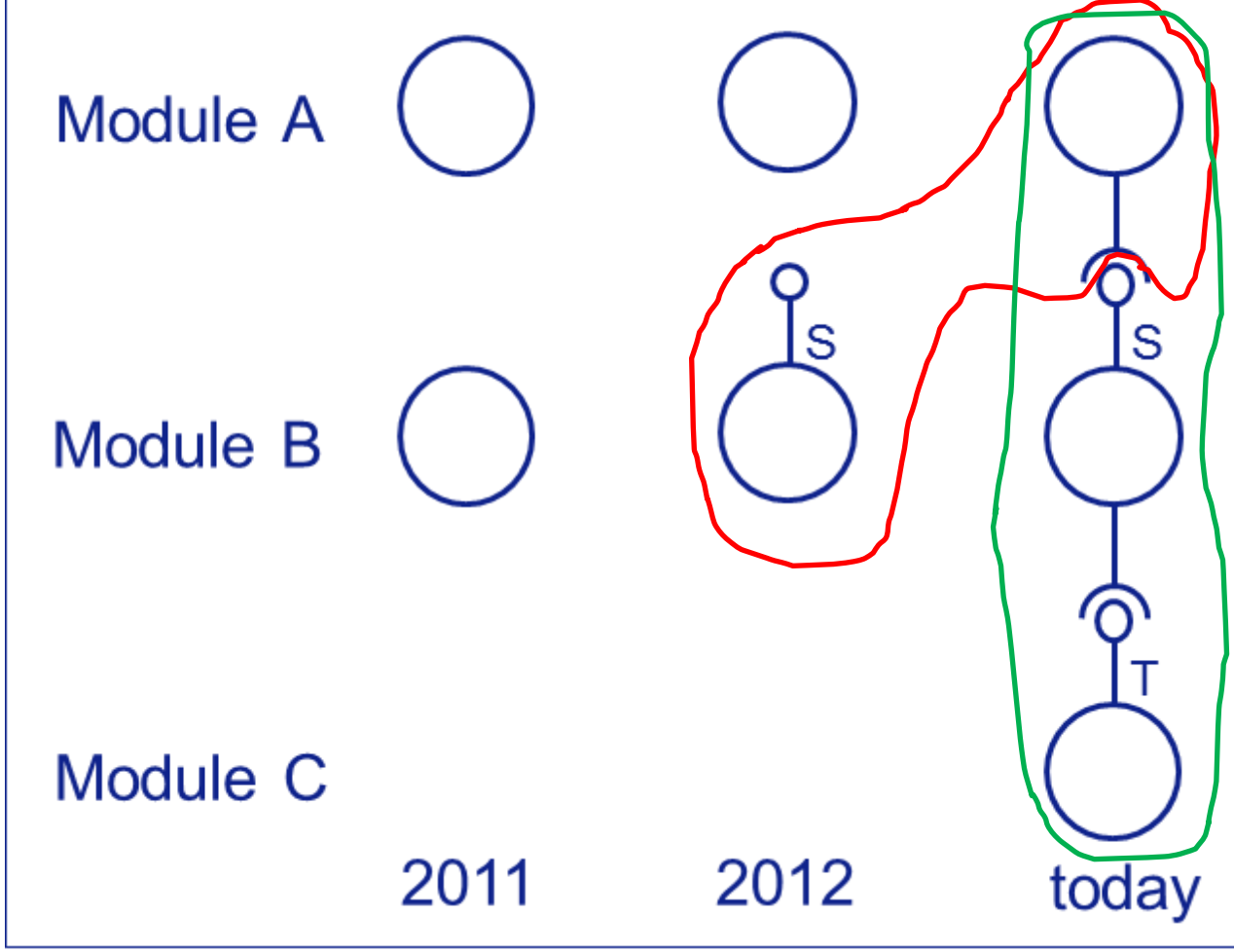


Goal: Update A to the current version



Goal: Update A to the current version

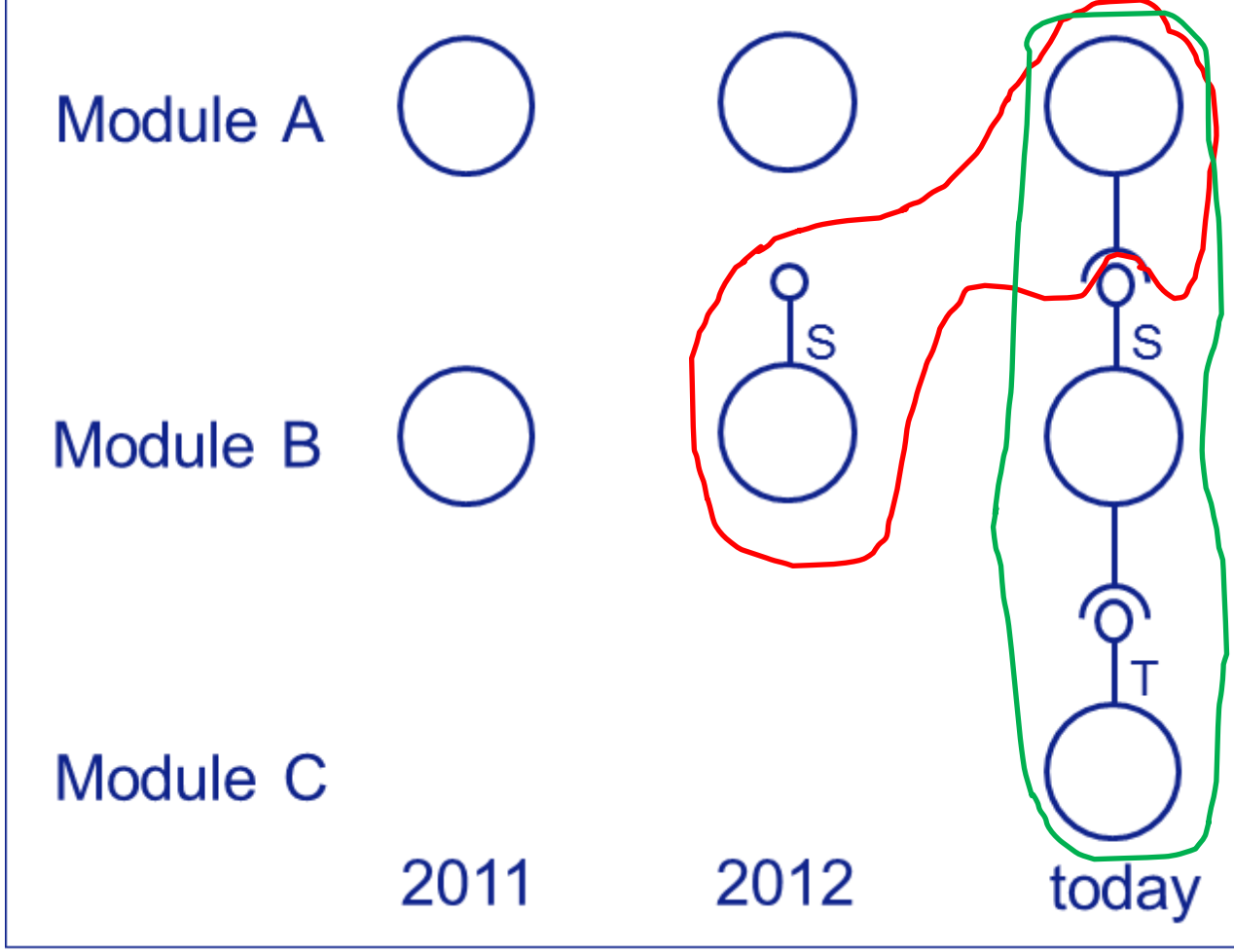
Solution 1 reduced the amount of code to be shipped to the customer



Solution 2 reduces the amount of shipments

Goal: Update A to the current version

Solution 1 reduced the amount of code to b… shi… …he …er



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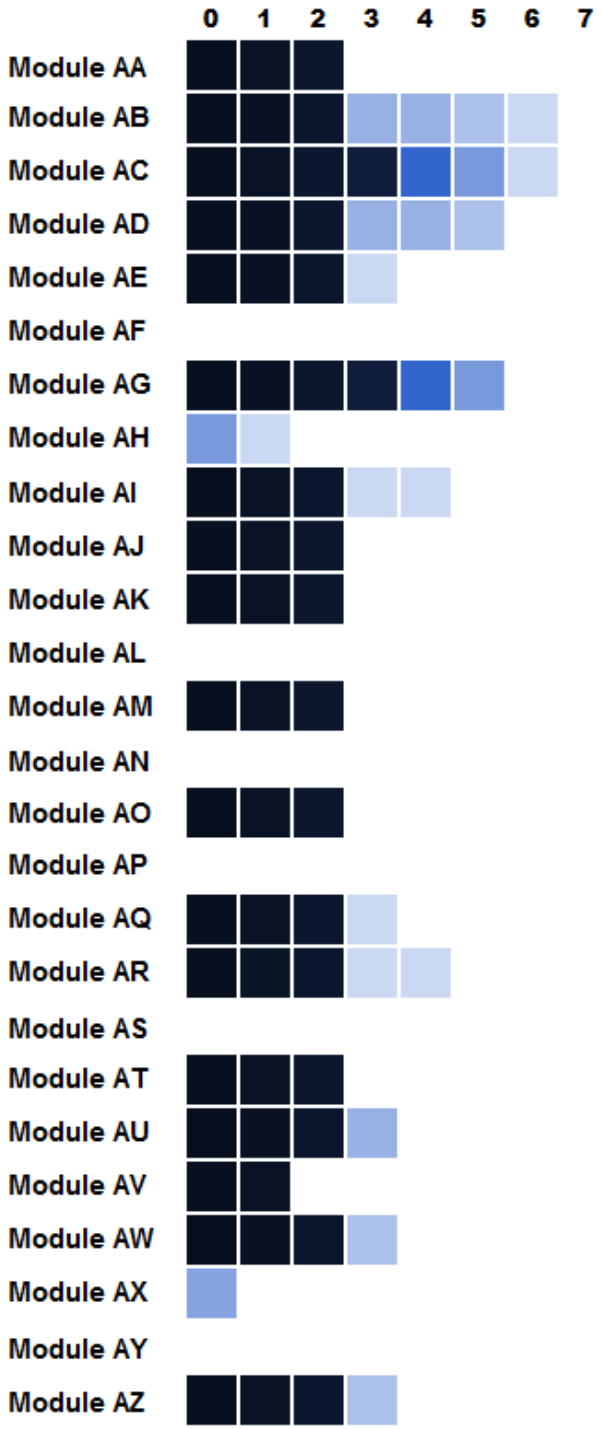
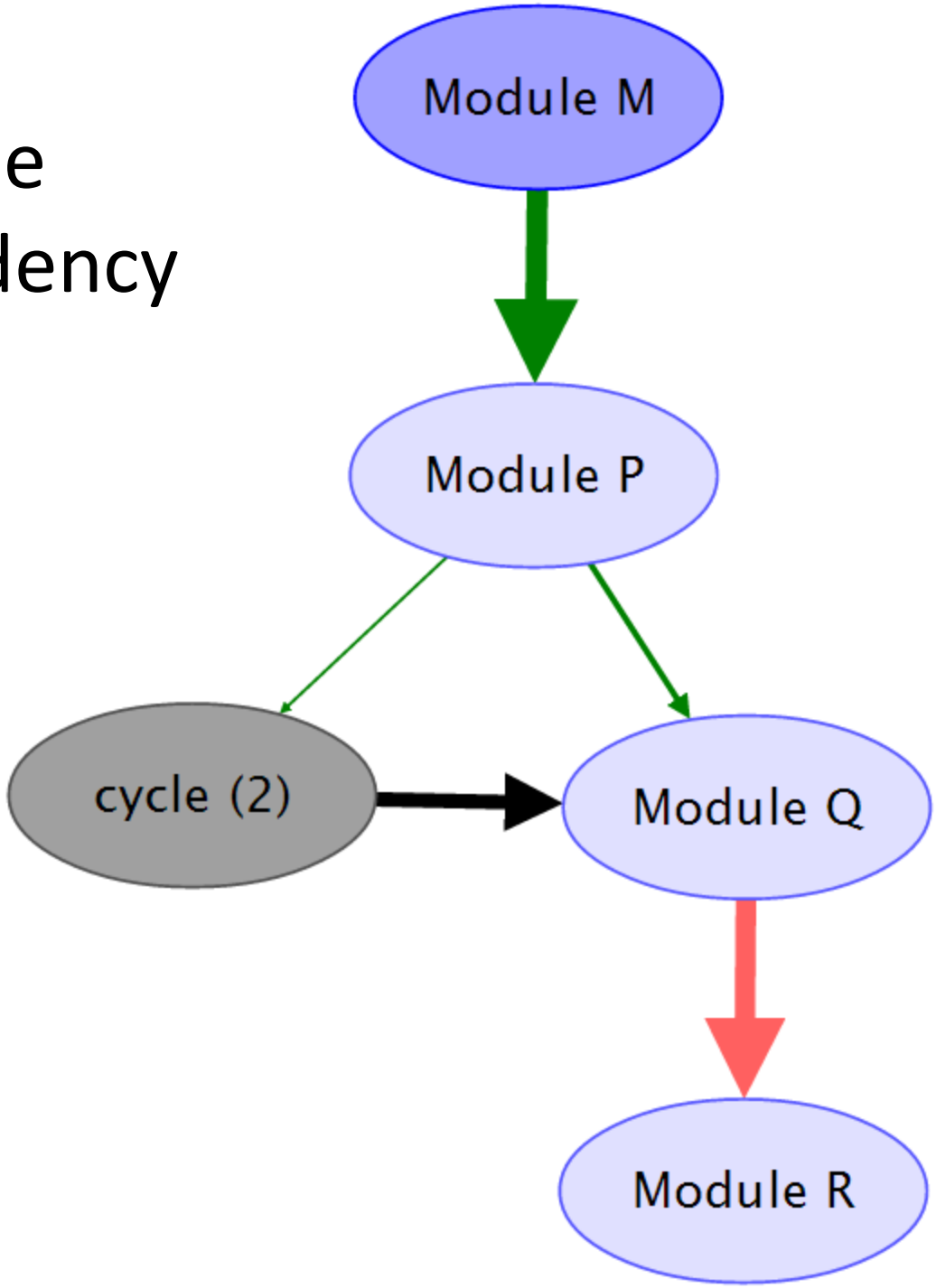


Color = #modules needed to upgrade when upgrading row from column to current (8).

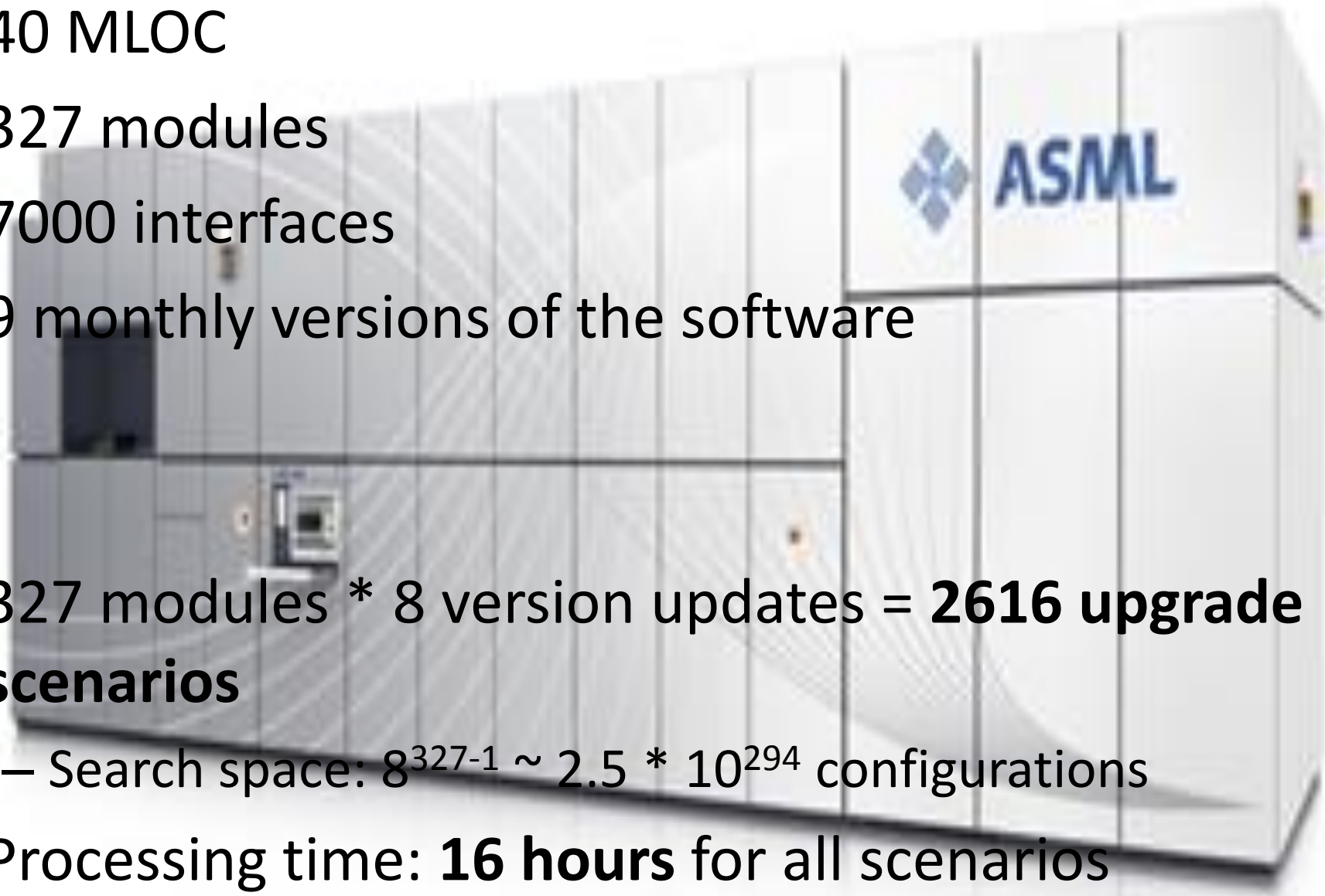
AF, AL, AS, AY are easy to upgrade, AC is difficult. Why?

Cliff between 2 and 3???

Upgrade dependency graph



- 1000 software developers
- 40 MLOC
- 327 modules
- 7000 interfaces
- 9 monthly versions of the software



- 327 modules * 8 version updates = **2616 upgrade scenarios**
  - Search space: $8^{327-1} \sim 2.5 * 10^{294}$ configurations
- Processing time: **16 hours** for all scenarios
  - With limitations on search space.

Cliff between 2 and 3

Inspecting upgrade dependency graphs, we've found many red dependencies, caused by symbol removal.

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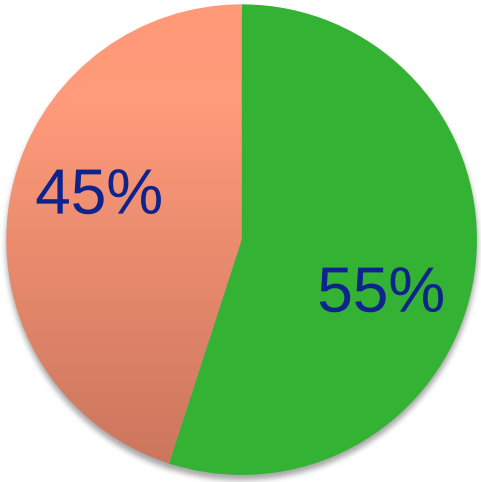
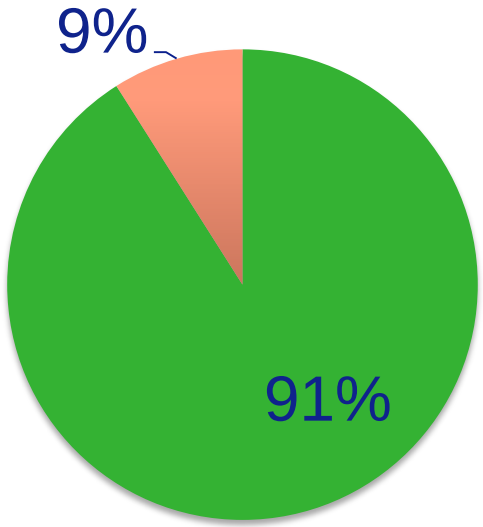


Red dependencies included



Red dependencies excluded

Cliff between 2 and 3

Inspecting upgrade dependency graphs, we've found many red dependencies, caused by symbol removal.

Suggestion: symbols are removed
only when they are no longer used in any supported release.

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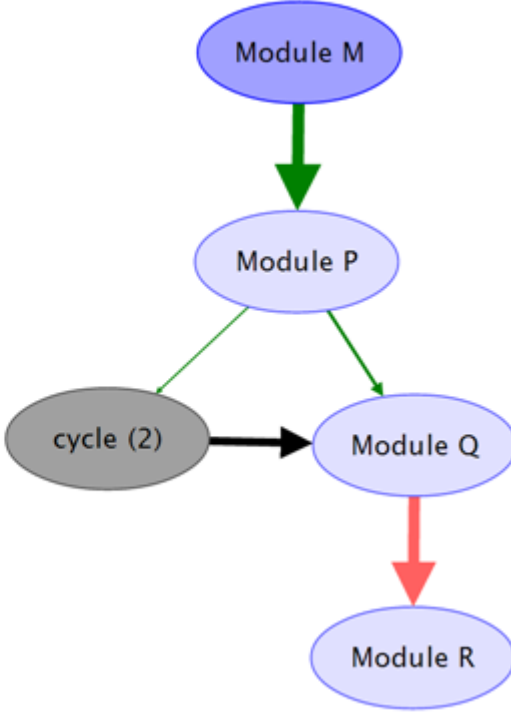

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