Performance Patterns, Pitfalls, and Approach

by *Gerrit Muller* HSN-NISE
e-mail: gaudisite@gmail.com
www.gaudisite.nl

Abstract

Performance Design is based on the application on many performance oriented patterns. Patterns are a way are to consolidate experience: what solution fits to what problem in what situation? Pitfalls are also a way to consolidate experience: what are common design mistakes?

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Case 6

Common Platforms and Bloating

Generic nature of platforms

Most SW implementations are way too big

Performance suffers from oversize and generic provisions

Exploring Bloating: Main Causes

>90% of all Software statements are not needed, but caused by:

- over-specification
- bad design
- too generic
- dogmatic rules
- legacy remains

core function
less than 10%

legend

overhead

value

Necessary Functionality $\gg$ Intended Regular Function

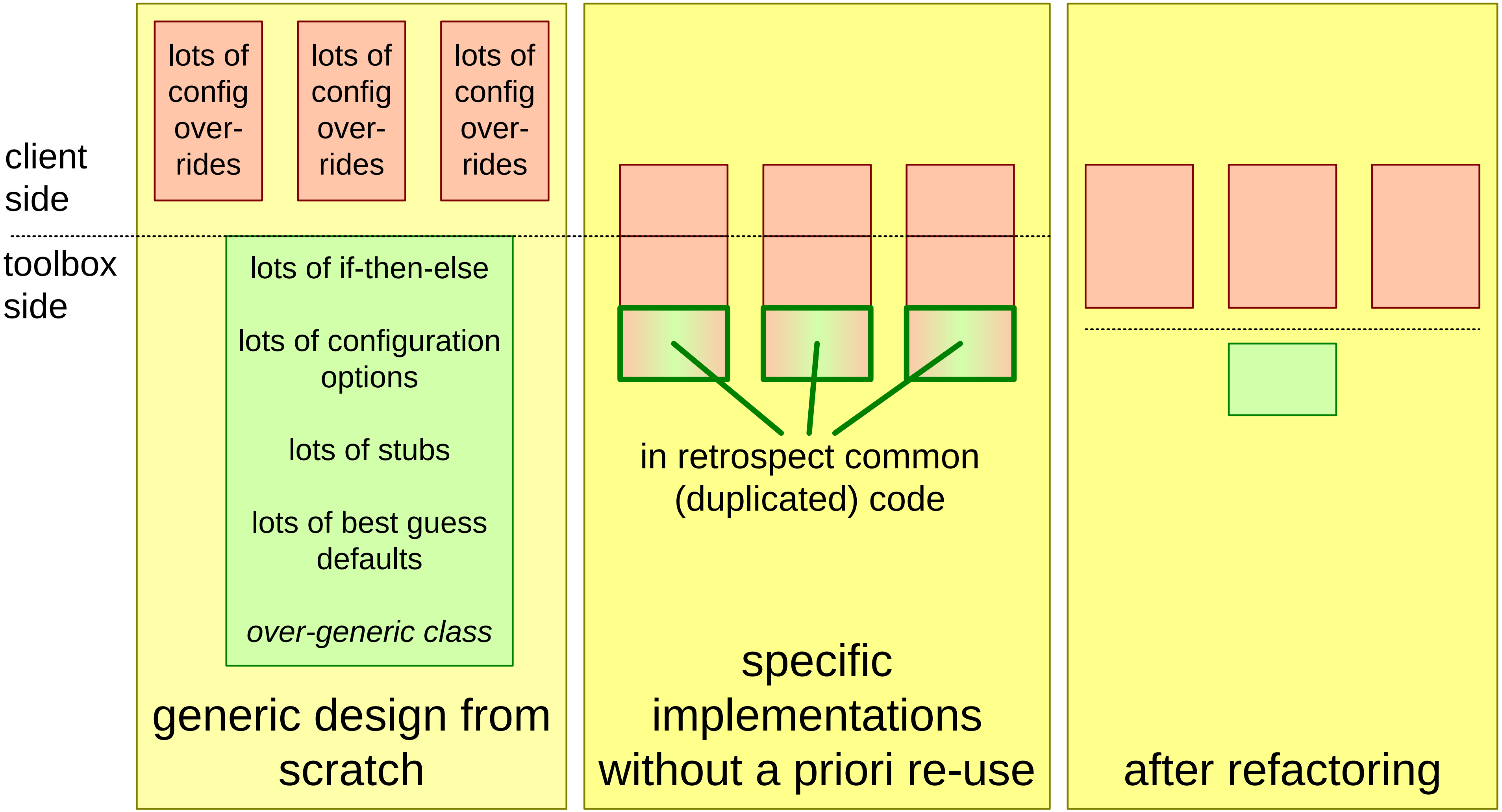
testing

regular functionality

instrumentation
- diagnostics
- tracing
- asserts

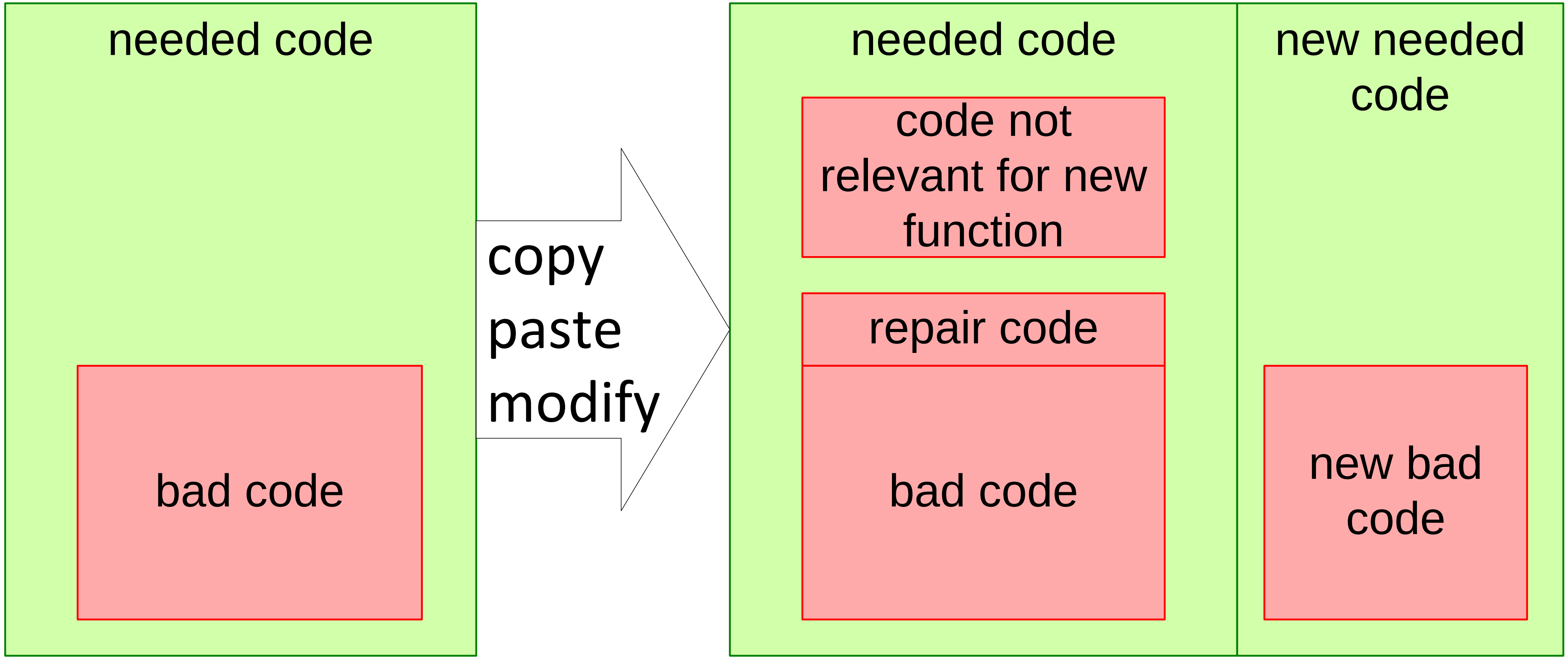
boundary behavior:
- exceptional cases
- error handling

The Danger of Being Generic: Bloating

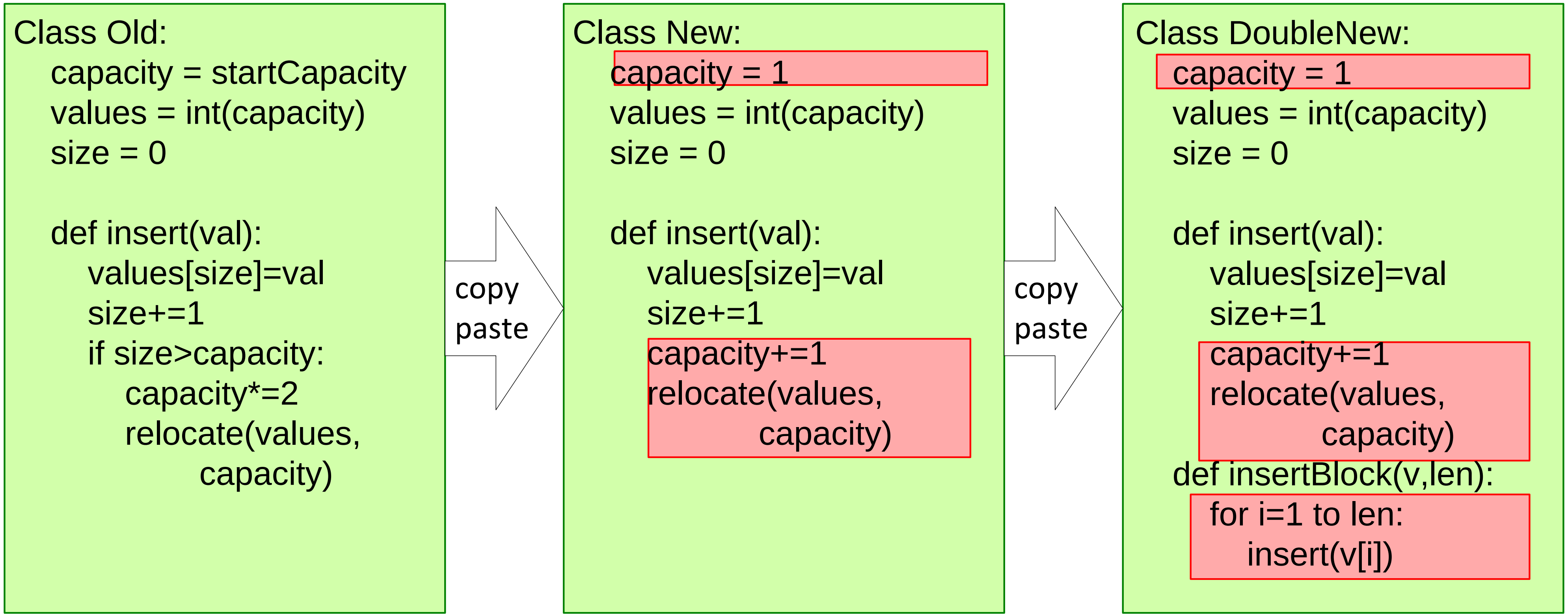


"Real-life" example: redesigned *Tool* super-class and descendants, ca 1994

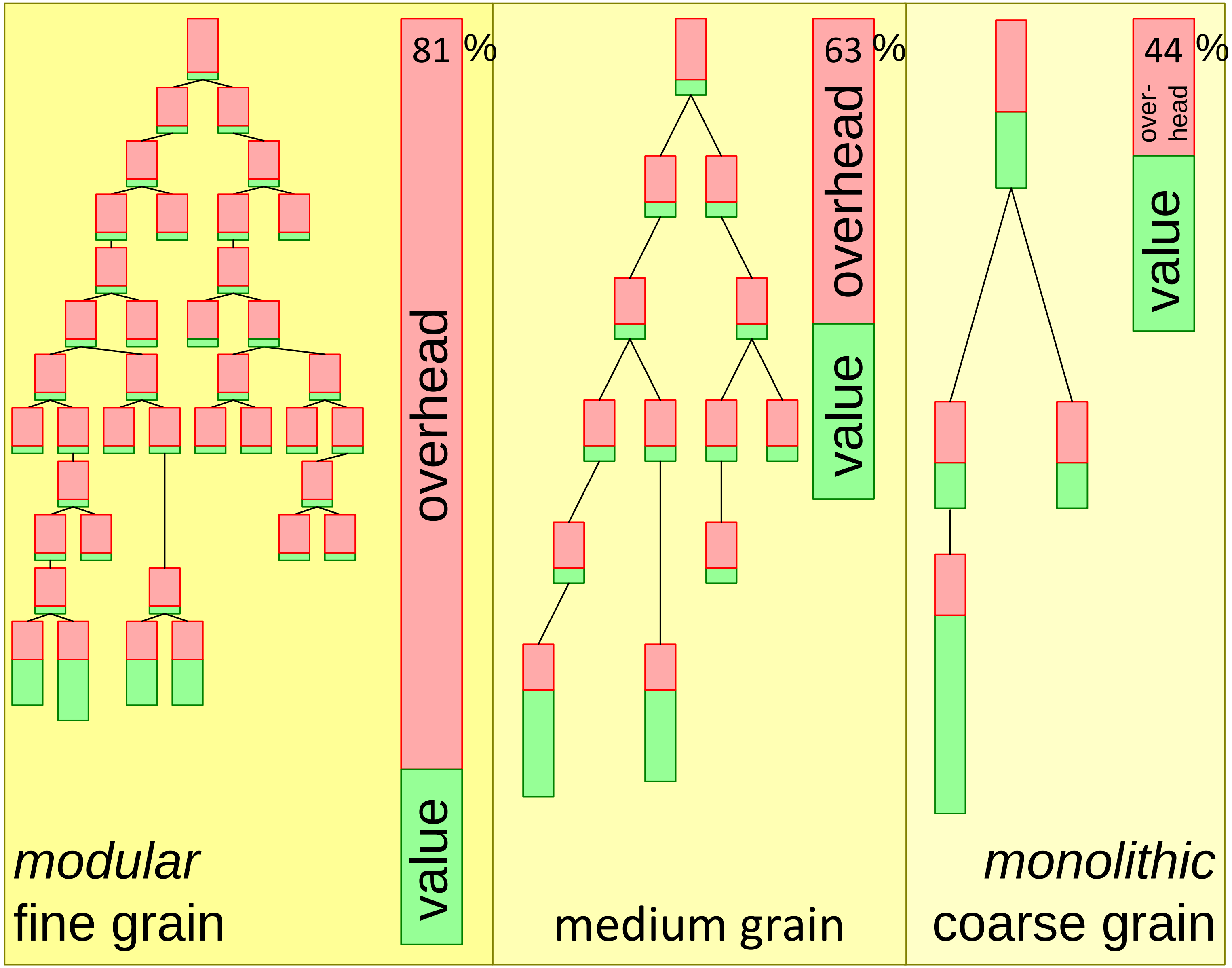
Problem Propagation via Copy & Paste



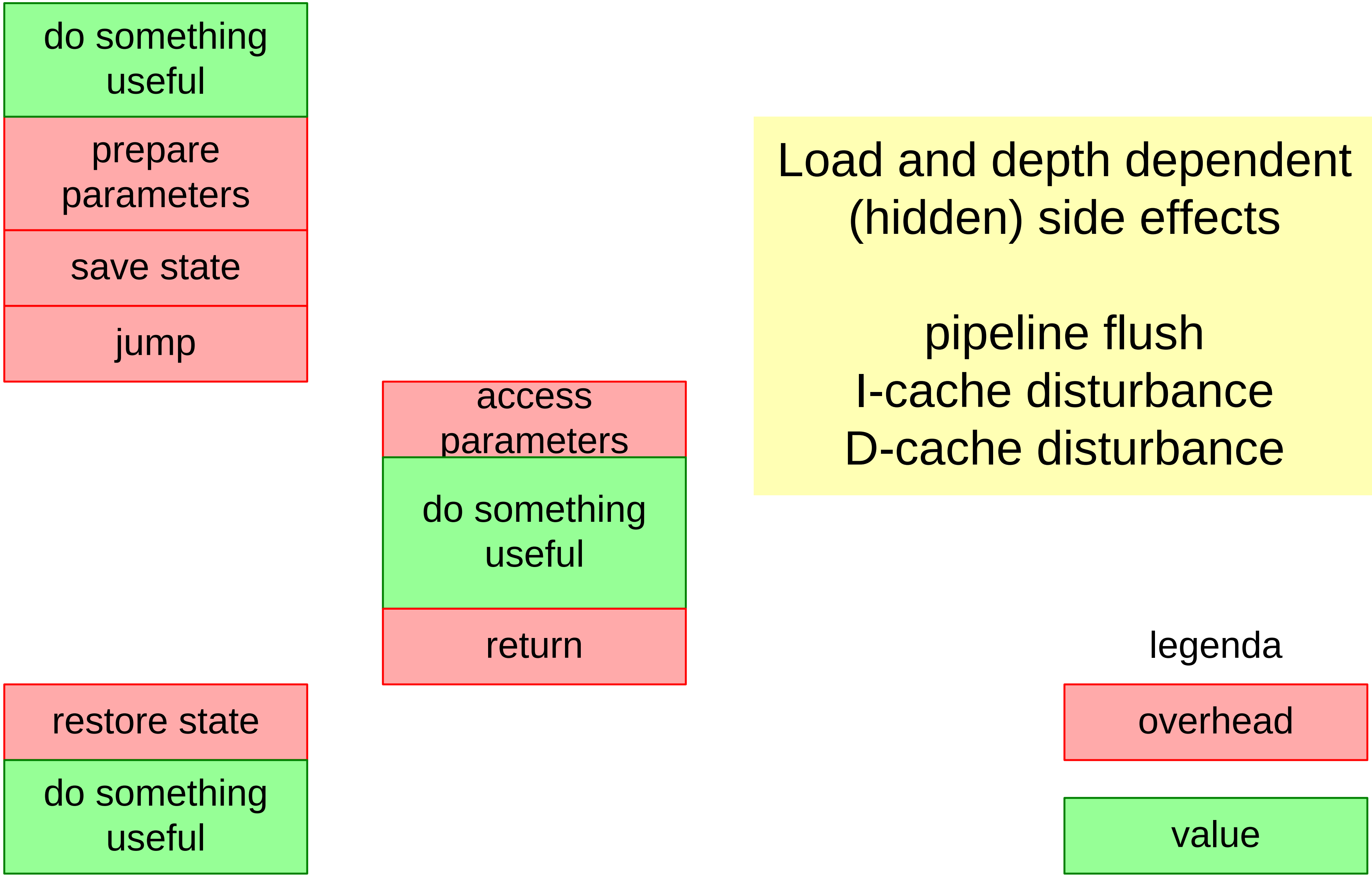
Example of Problem Propagation



Overhead Penalty of Modularity



Function Call Overhead



Suppose:

Call Overhead = 10µs
Call graph branching factor = 2
Depth = 12

What is the Call overhead
when all branches are followed?

Exercise Frame Rate for Layered SW

Suppose:

Function call = 10µs
Call layer depth = 20
1024 calls per image

What is the maximum frame rate possible assuming that the complete CPU time is available for function calls?

Case 6

Common Platforms and Bloating

Platforms are overprovisioned and very generic

Are benefits > disadvantages?

Performance loss is significant and can be measured and modelled

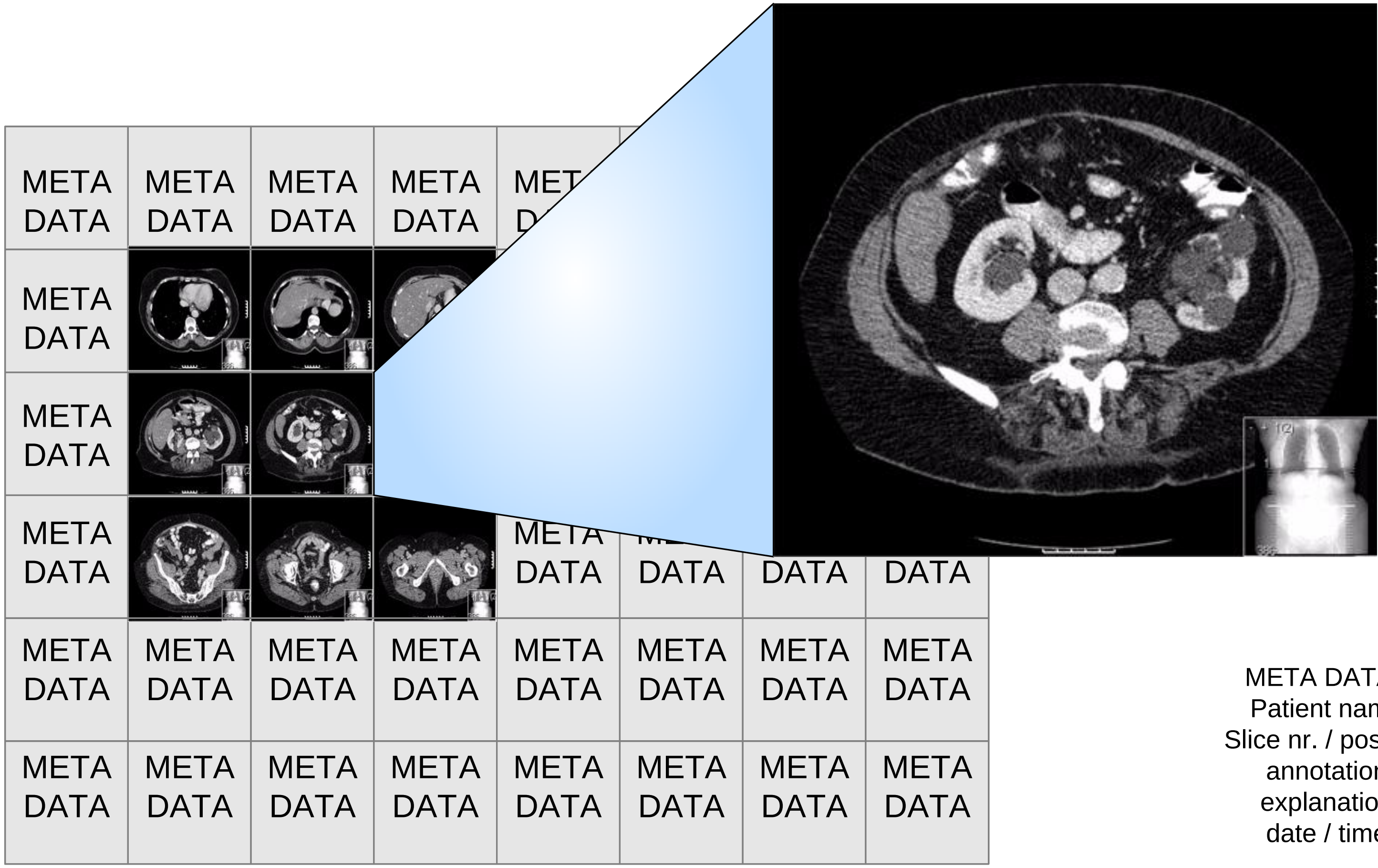
Multi-Dimensional Viewing of many Images: Greedy and Lazy Design Patterns

Greedy and Lazy systems

Greedy: pre-fetched lots of data:
System tries to have data available for the requesting system

Lazy: hardly of no pre-fetching of data:
System tries to set data available for the requesting system
only when asked for

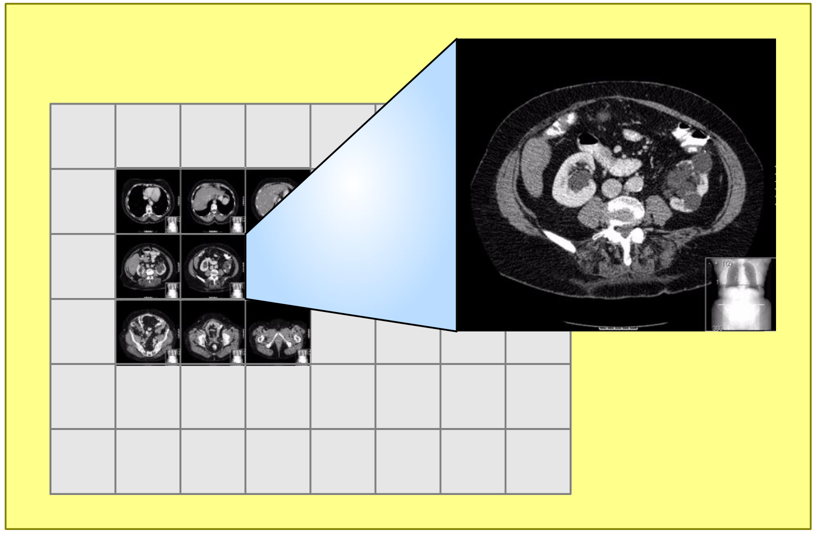
Example Greedy / Lazy (1)



META DATA=
Patient name
Slice nr. / position
annotation
explanation
date / time

Example Greedy / Lazy (2)

Lazy: Fetch only
the requested image



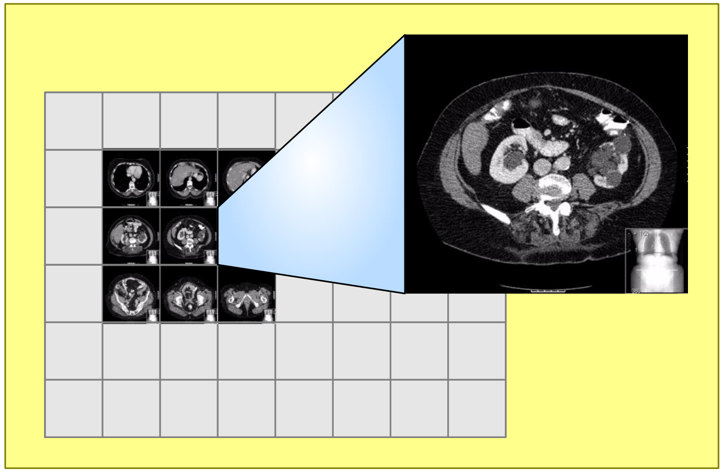
Greedy: Fetch all the images
in the set

In between options:

- Fetch requested image + surrounding images

- Fetch requested image + only meta information of images

Example Greedy / Lazy (3)



Lazy:
- low load on system
- long waiting time for next image

Greedy:
- high load on system
- possible long initial wait
- short response time insteady state

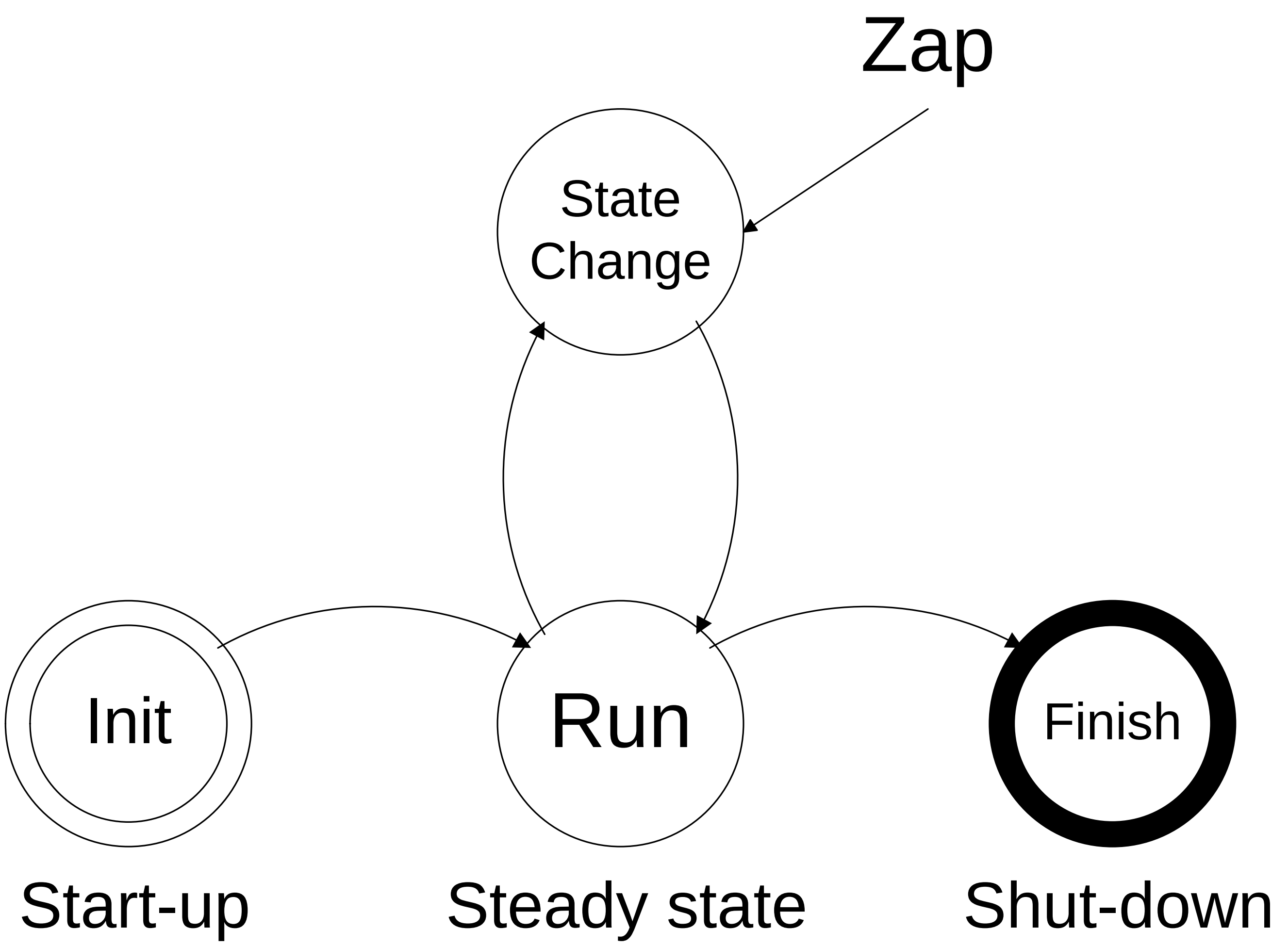
In between options:

- medium system load

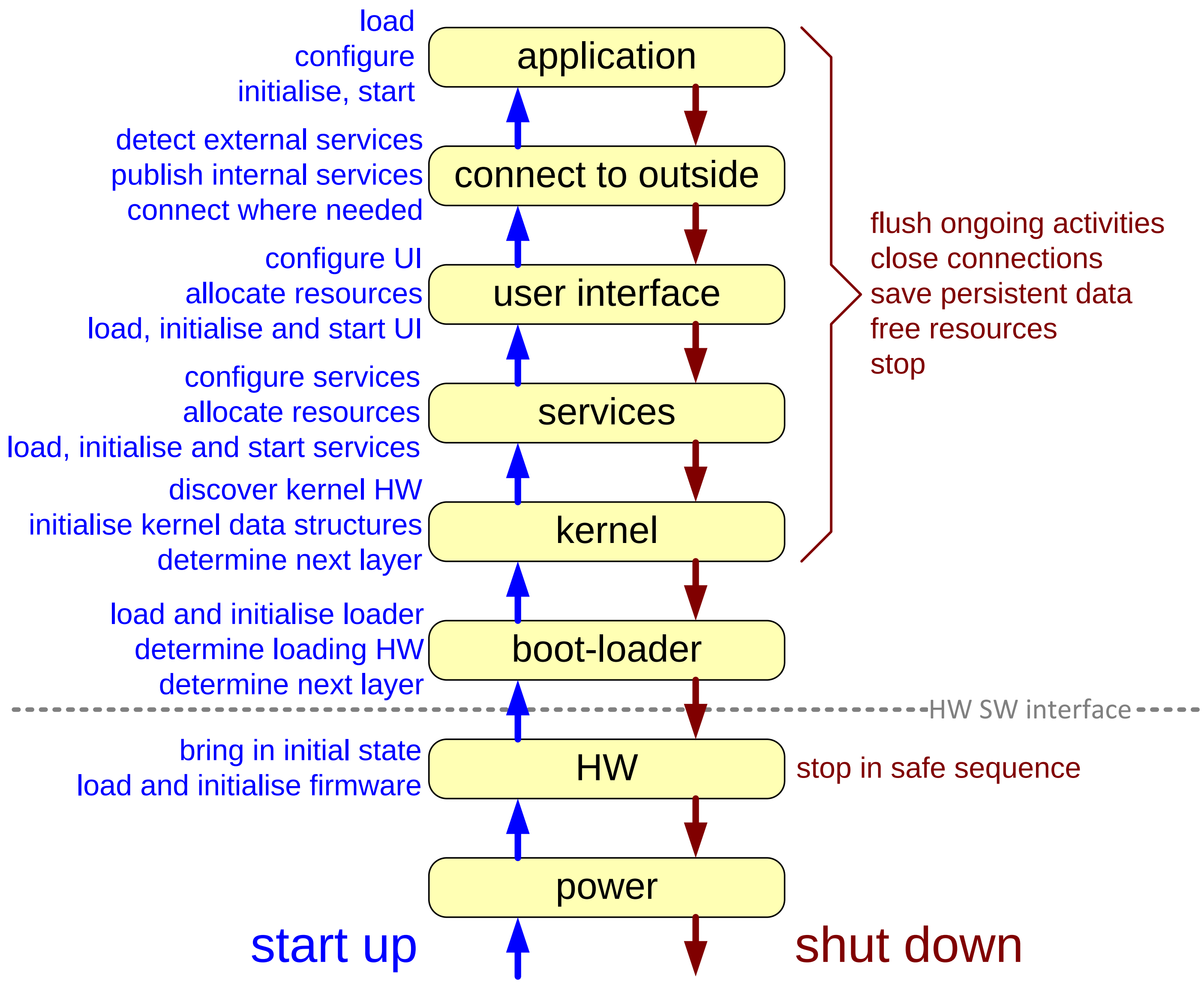
- fast response for initialization and common image fetches

Initialization, Steady State and Finalization

Start-up, Steady State, Shut Down



Start-up, Steady State, Shut Down Scheme

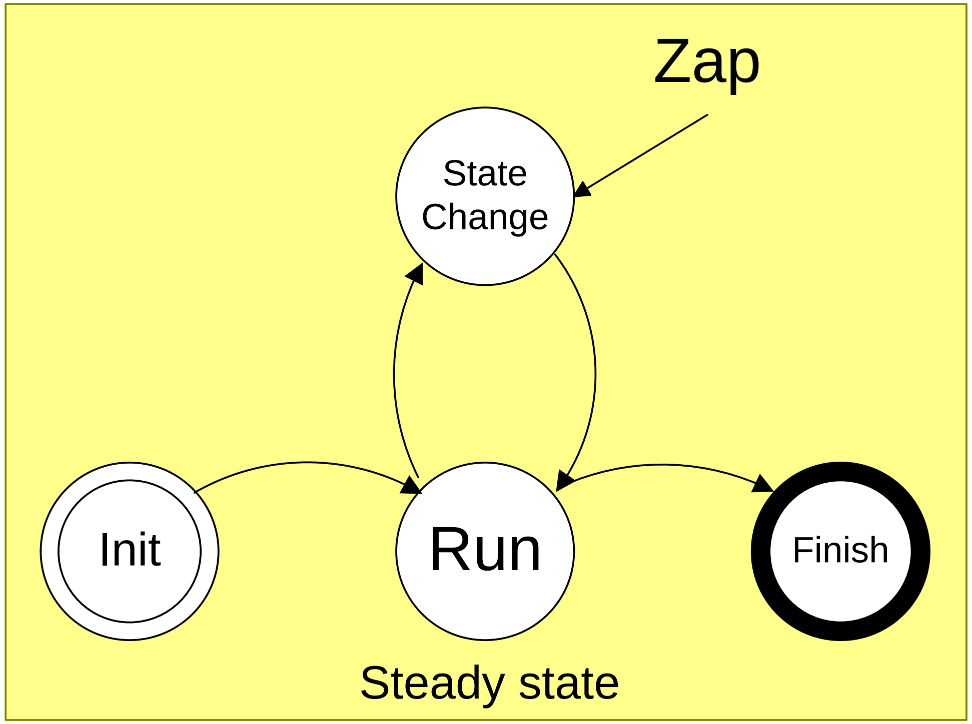


Start-up, Steady State, Shut Down Trade off

Trade-off:

Optimize on steady state
may result in
poor performance for initialization
and process finish

Optimize on Initialization and/or finish
may result in
poor steady state performance



Common Performance Pitfalls

- Overhead
- Data bloating
- Cache thrashing
- Layering
- Process communication
- Conversions
- Serialization
- Backfiring optimalisations
- Hidden loads (bus, DMA etc)
- Poor algorithms
- Wrong dimensioning

Colofon

The ASP™ course is partially derived from the EXARCH course developed at *Philips CTT* by *Ton Kostelijk* and *Gerrit Muller*.

Extensions and additional slides have been developed at *ESI* by *Teun Hendriks*, *Roland Mathijssen* and *Gerrit Muller*.