Modeling and Analysis: Analysis

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Abstract

Models only get value when they are actively used. We will focus in this presentation on analysis aspects: accuracy, credibility, sensitivity, efficiency, robustness, reliability and scalability.

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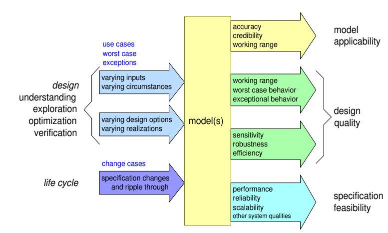
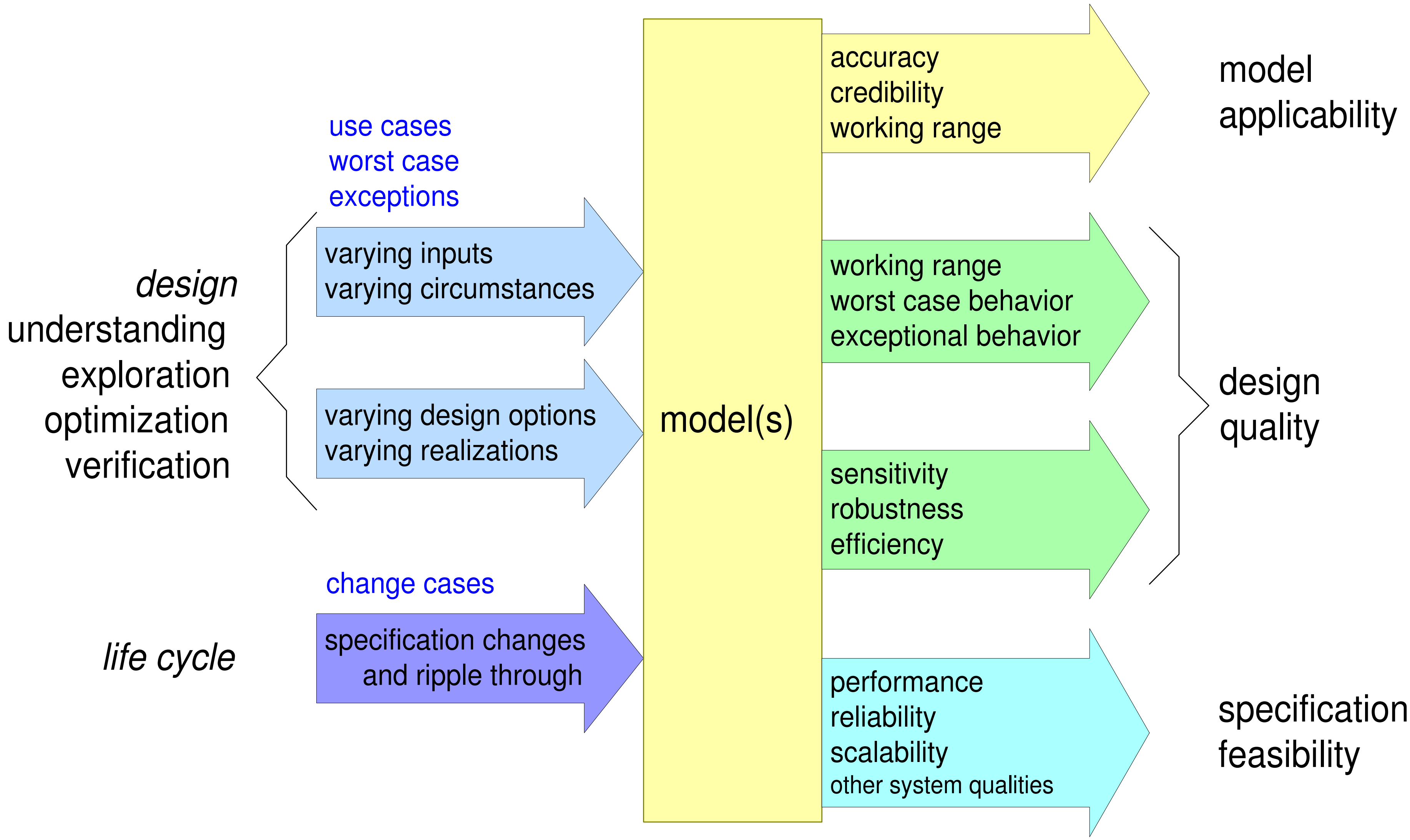
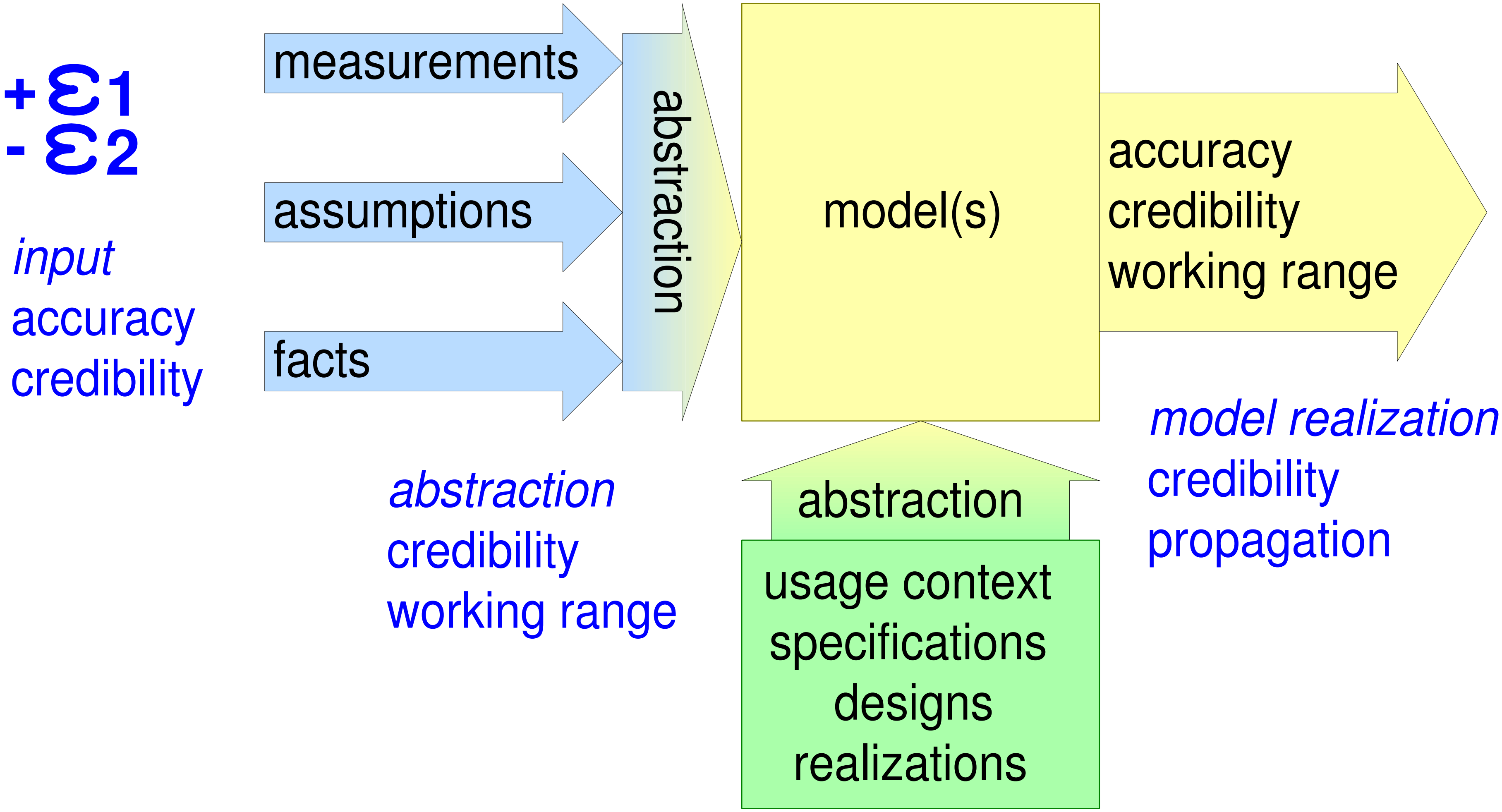


What Comes out of a Model



Applicability of the Model



How to Determine Applicability

try out models

be aware of accuracy, credibility and working range

simple and small models

1. Estimate accuracy of results

   based on most significant inaccuracies of inputs
   and assumed model propagation behavior

2. Identify top 3 credibility risks

   identify biggest uncertainties in
   inputs, abstractions and realization

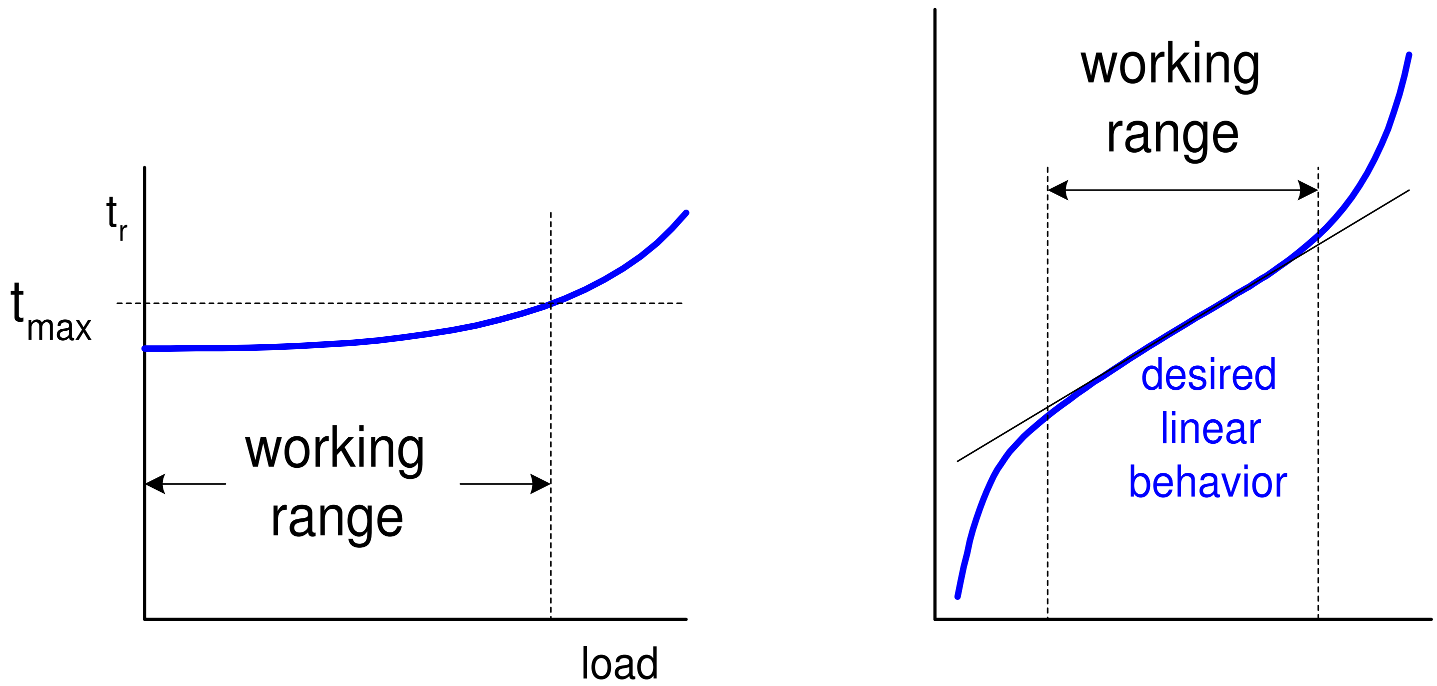
3. Identify relevant working range risks

   identify required (critical) working ranges and
   compare with model working range

substantial models

systematic analysis and documentation of accuracy,
credibility and working range

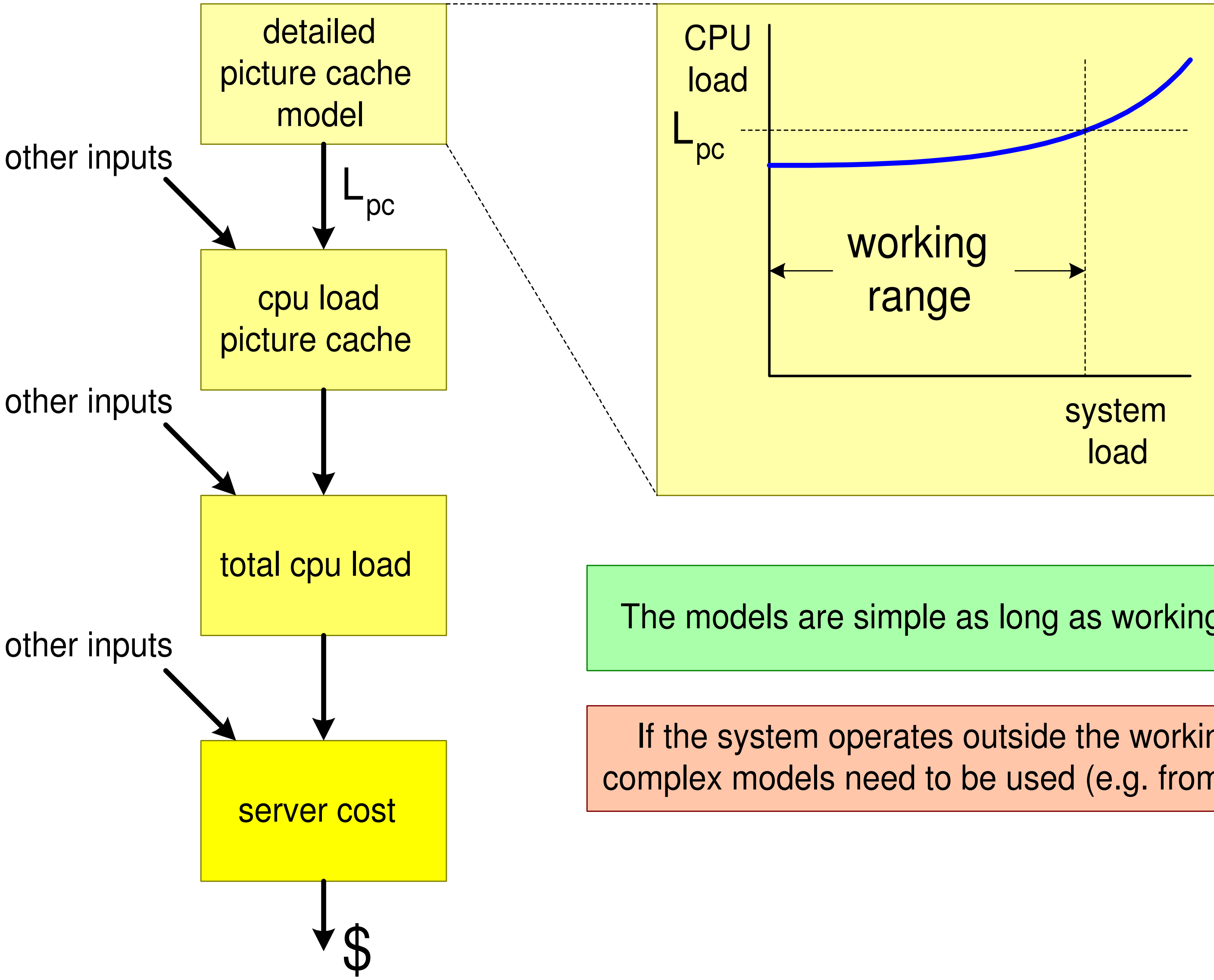
Working Range examples



A system design assumption is often:
the performance of this function
{ is constant | is linear | doesn't exceed x | ...}

The working range is the interval where this assumption holds

Example of Picture Cache Working Range



The models are simple as long as working ranges are obeyed

If the system operates outside the working range then more complex models need to be used (e.g. from 0 ^{e} order to 1 ^{e} order)

Common Pitfalls

discrete events in continuous world

discretization artefacts
e.g. stepwise simulations

(too) systematic input data

random data show different behavior
e.g. memory fragmentation

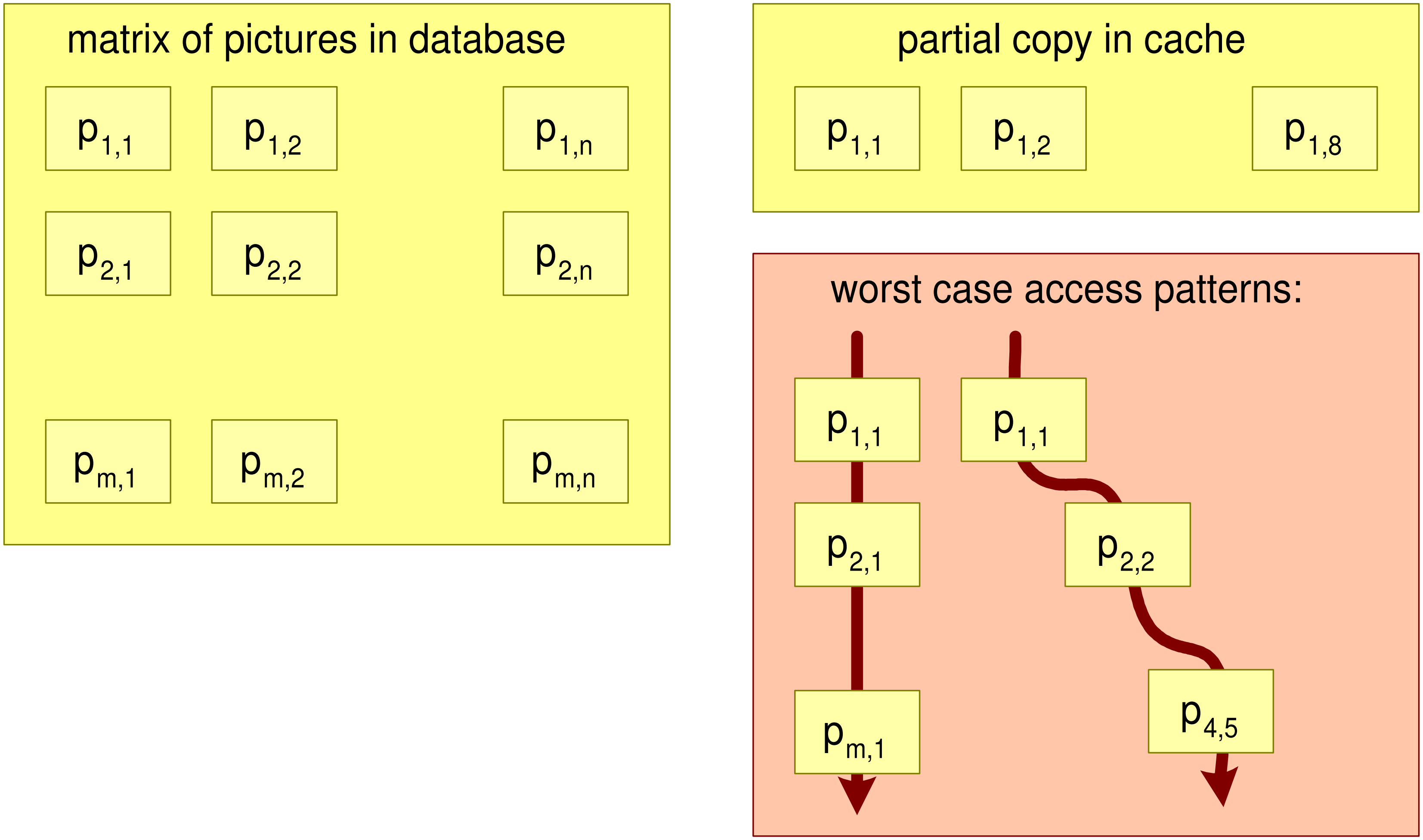
fragile model

small model change results in large shift in results

self fulfilling prophecy

price erosions + cost increase (inflation) -> bankruptcy

Example of Worst Case Picture Cache



What is the system behavior and performance for worst case access patterns?

Worst Case Questions

Which design assumptions have a big impact on system performance?

What are the worst cases for these assumptions?

How does the system behave in the worst case?

a. poor performance within spec

b. poor performance not within spec

c. failure -> reliability issue

FMEA-like Analysis Techniques

	(systematic) brainstorm	analysis and assessment probability severity propagation	improve spec, design, process, procedure, ...
safety hazard analysis	potential hazards	damage	measures
reliability FMEA	failure modes exceptional cases	effects	measures
security	vulnerability risks	consequences	measures
maintainability	change cases	impact, effort, time	decisions
performance	worst cases	system behavior	decisions

Brainstorming Phases

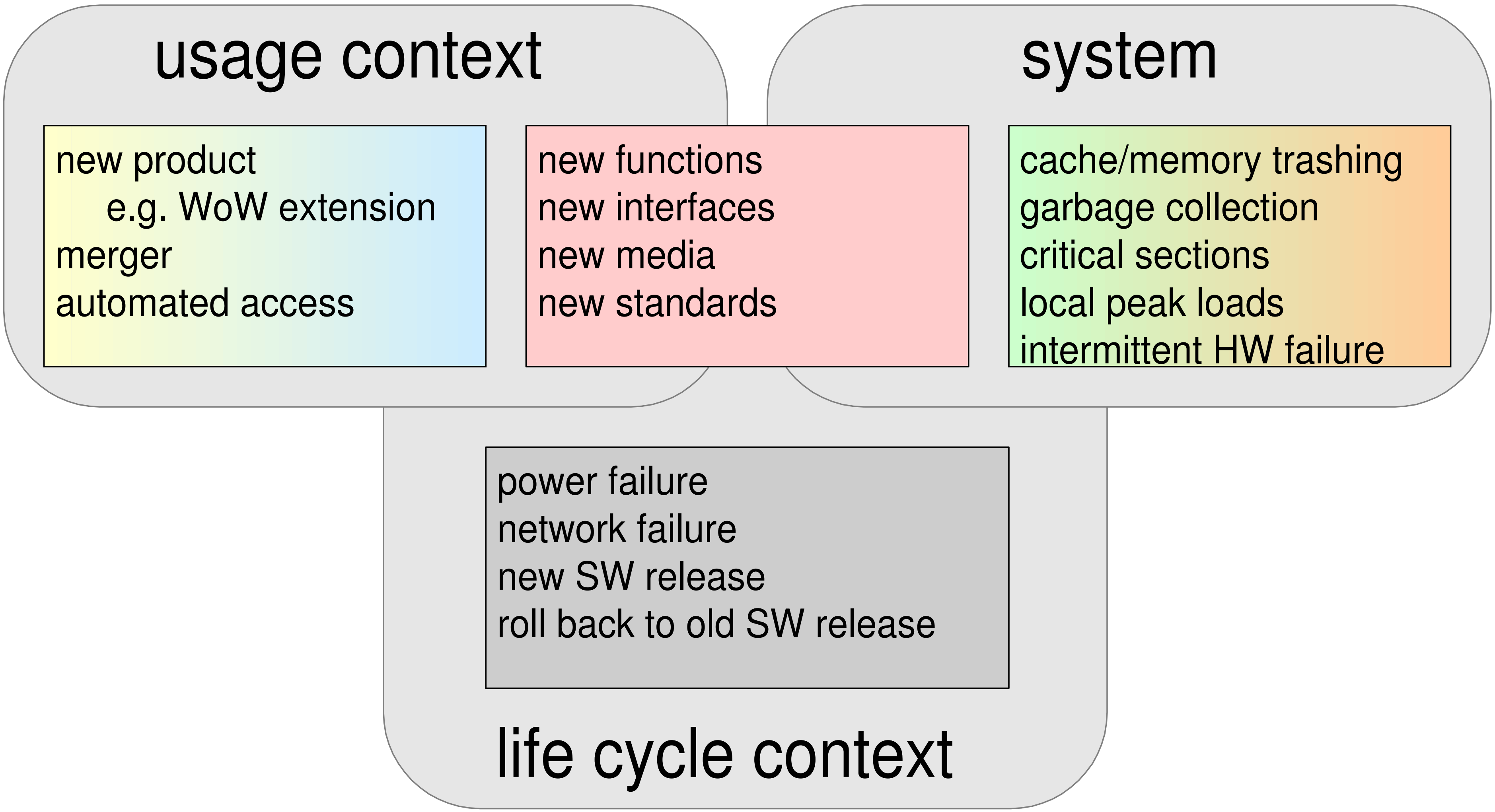
wave 1: the obvious

wave 2: more of the same

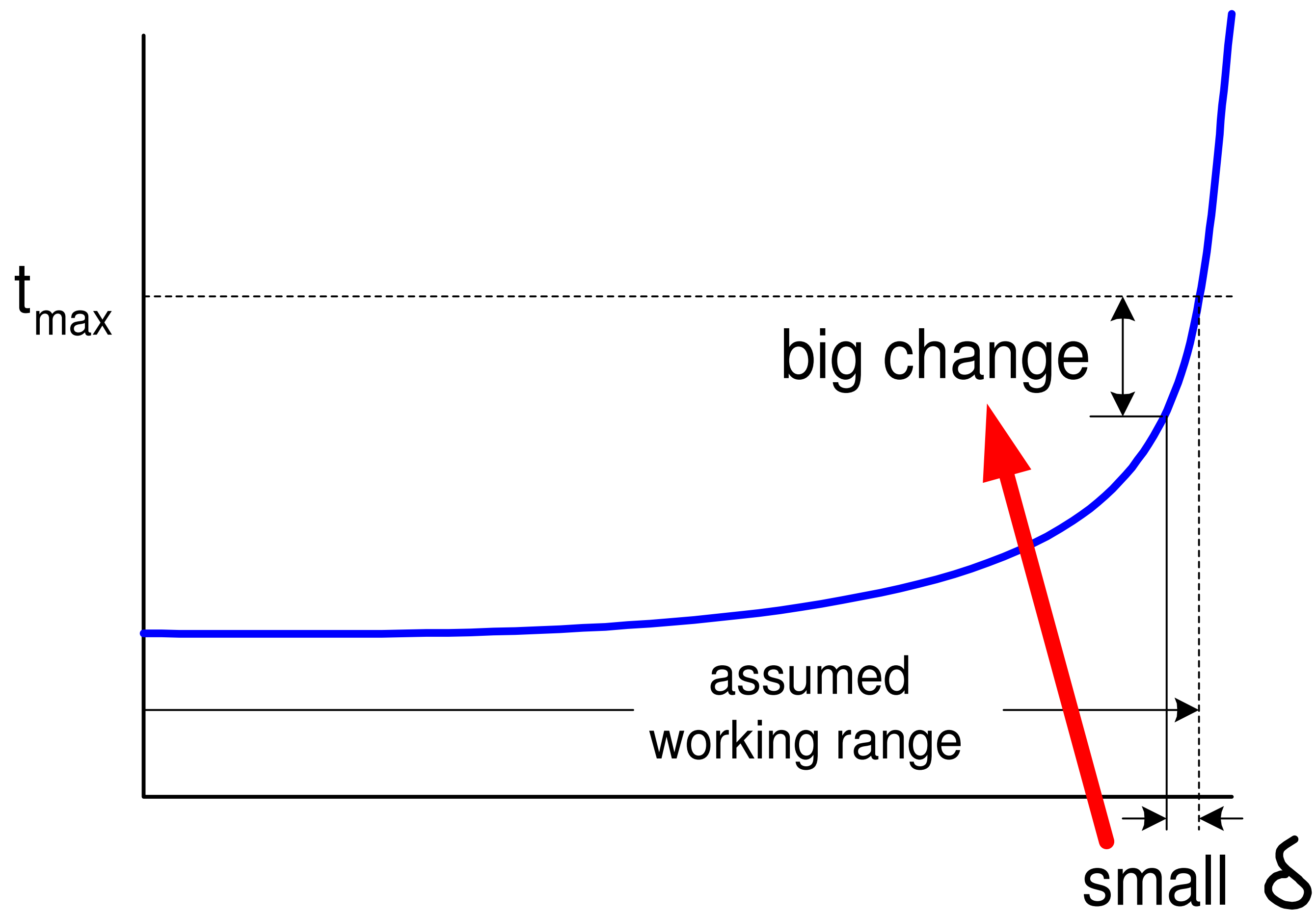
wave 3: the exotic, but potentially important

don't stop too early with brainstorming!

Different Viewpoints for Analysis



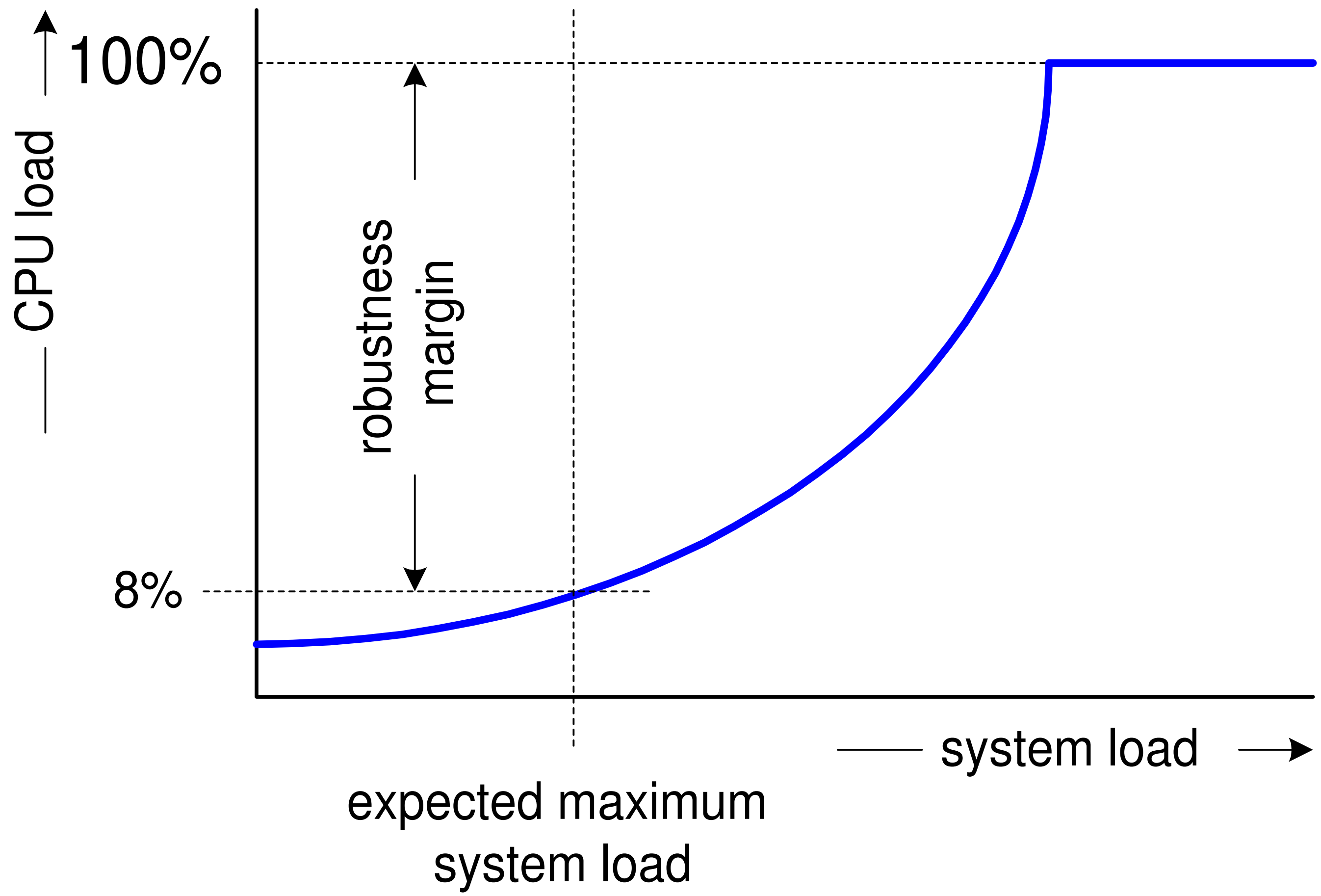
Example Sensitivity



sensitivity: how sensitive is the system output for small changes in input or realization?

Example of CPU Utilization and Efficiency

CPU utilization is "only" 8%
what is the efficiency?



Efficiency is Context Dependent!