

Architecting System Performance; Resource Management

by *Gerrit Muller* [TNO-ESI, University of South-Eastern Norway]

e-mail: `gaudisite@gmail.com`

`www.gaudisite.nl`

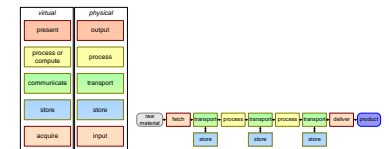
Abstract

The management of the resources largely determines system performance. This document discusses concepts related to resource management, such as caching, concurrency, and scheduling.

Distribution

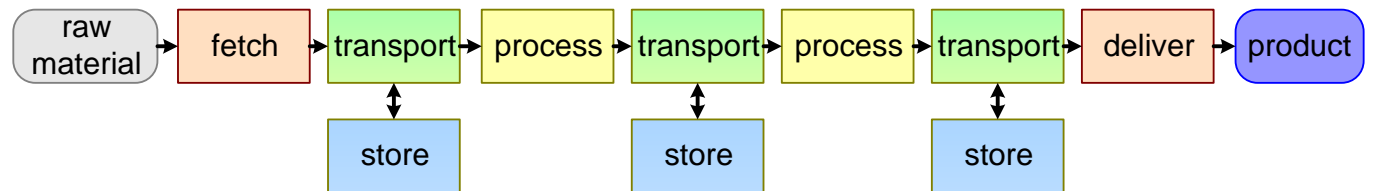
This article or presentation is written as part of the Gaudí project. The Gaudí project philosophy is to improve by obtaining frequent feedback. Frequent feedback is pursued by an open creation process. This document is published as intermediate or nearly mature version to get feedback. Further distribution is allowed as long as the document remains complete and unchanged.

August 16, 2025
status: preliminary
draft
version: 0.1



Generic Resource Model

<i>virtual</i>	<i>physical</i>
present	output
process or compute	process
communicate	transport
store	store
acquire	input



Design Considerations for Resource Management

Performance depends on resource utilization and management.

The design of the logistics, how does EMI¹ flow through the resources, is critical.

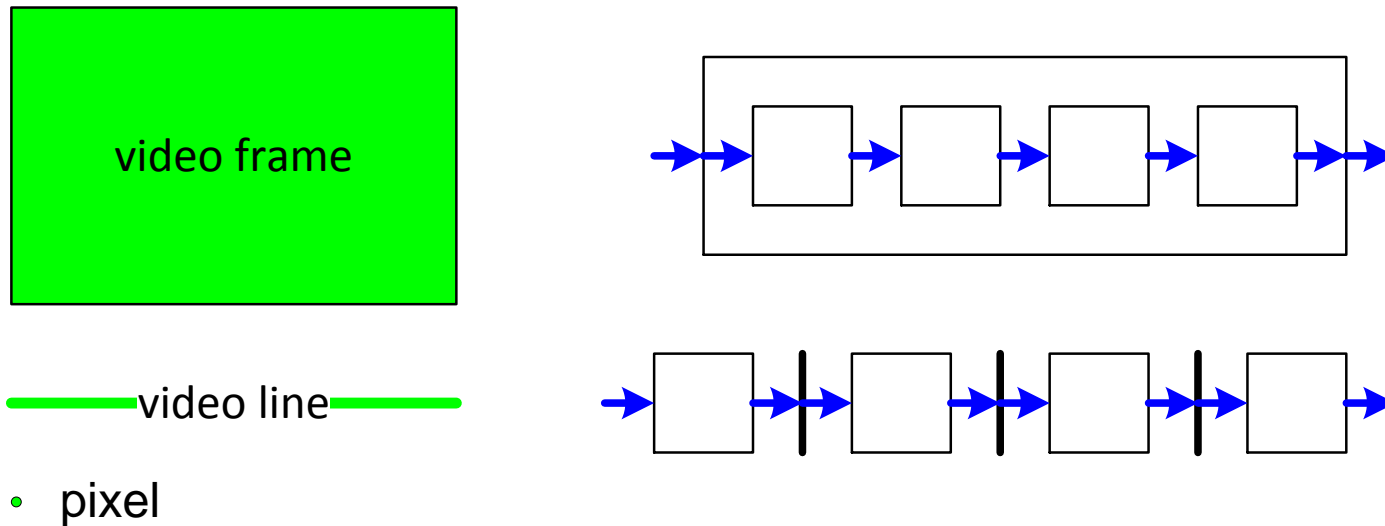
Critical design aspects are:

- concurrency (parallelism, pipelining)
- granularity of EMI
- scheduling (allocation of resources)

¹Energy Material Information

Granularity as Key Design Choice

unit of buffering == *unit of synchronization* == *unit of processing* == *unit of I/O*
or
<>



fine grain:
flexible
high overhead

coarse grain:
rigid
low overhead

Size versus Performance Trade off

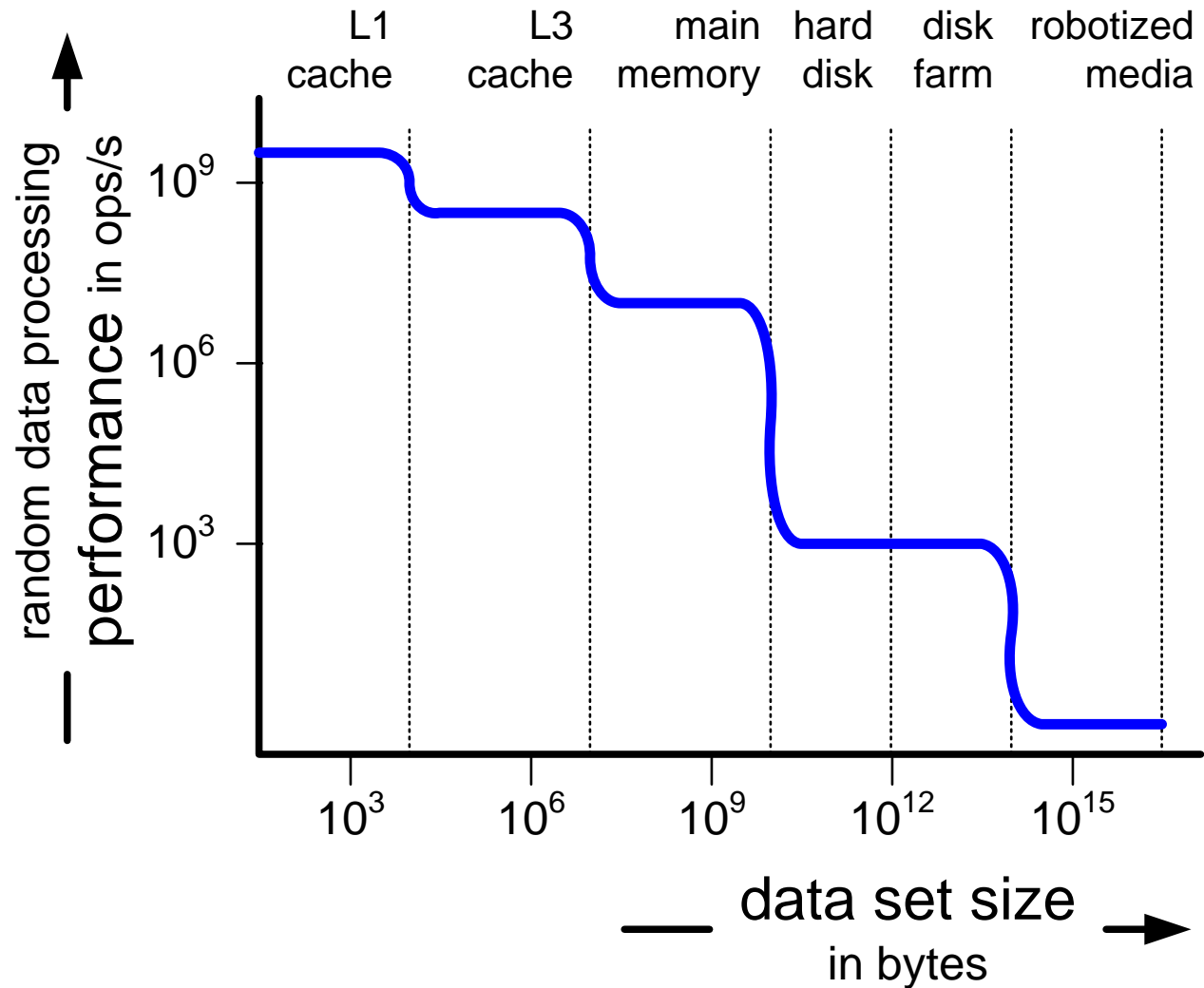
small capacity

fast technology
small
expensive

large capacity

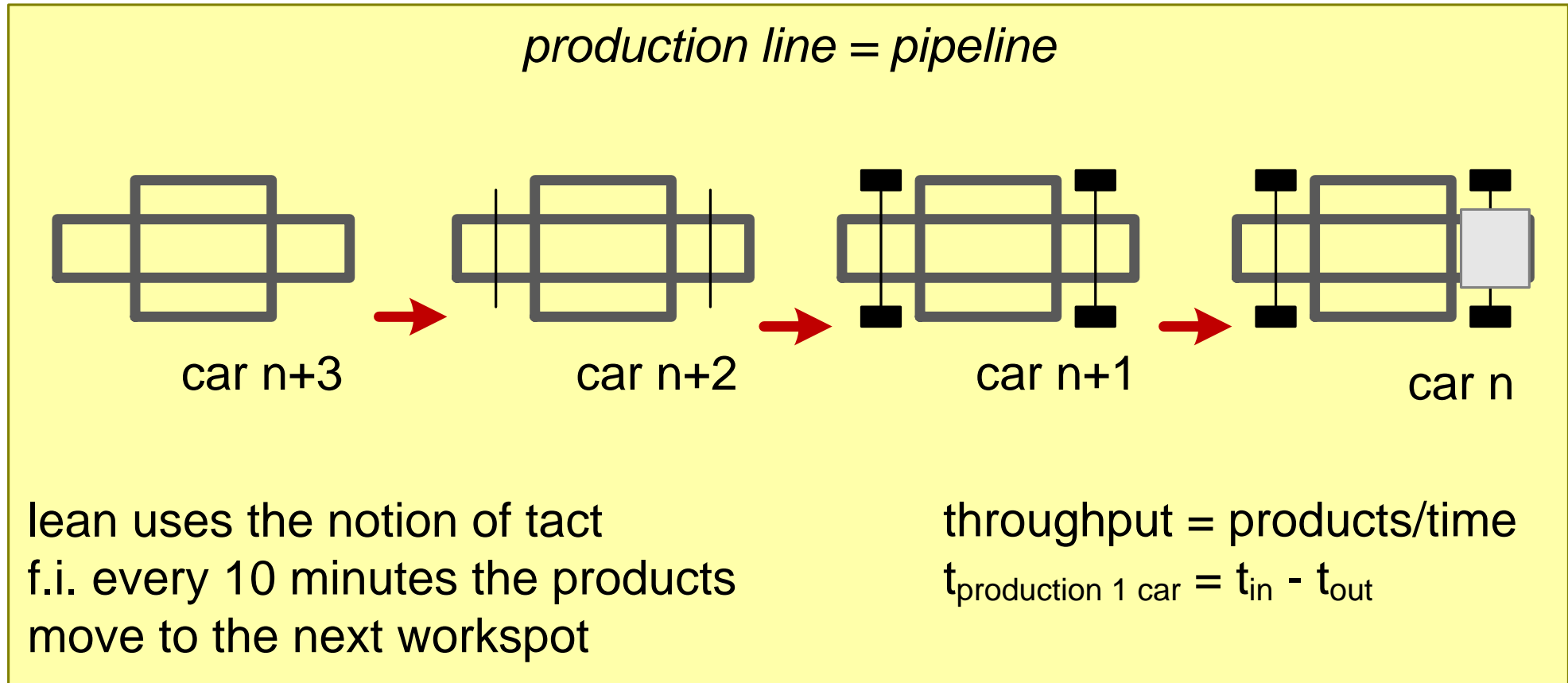
slow technology
large
low cost

staircase effect:
performance and
size are non-linear
with thresholds

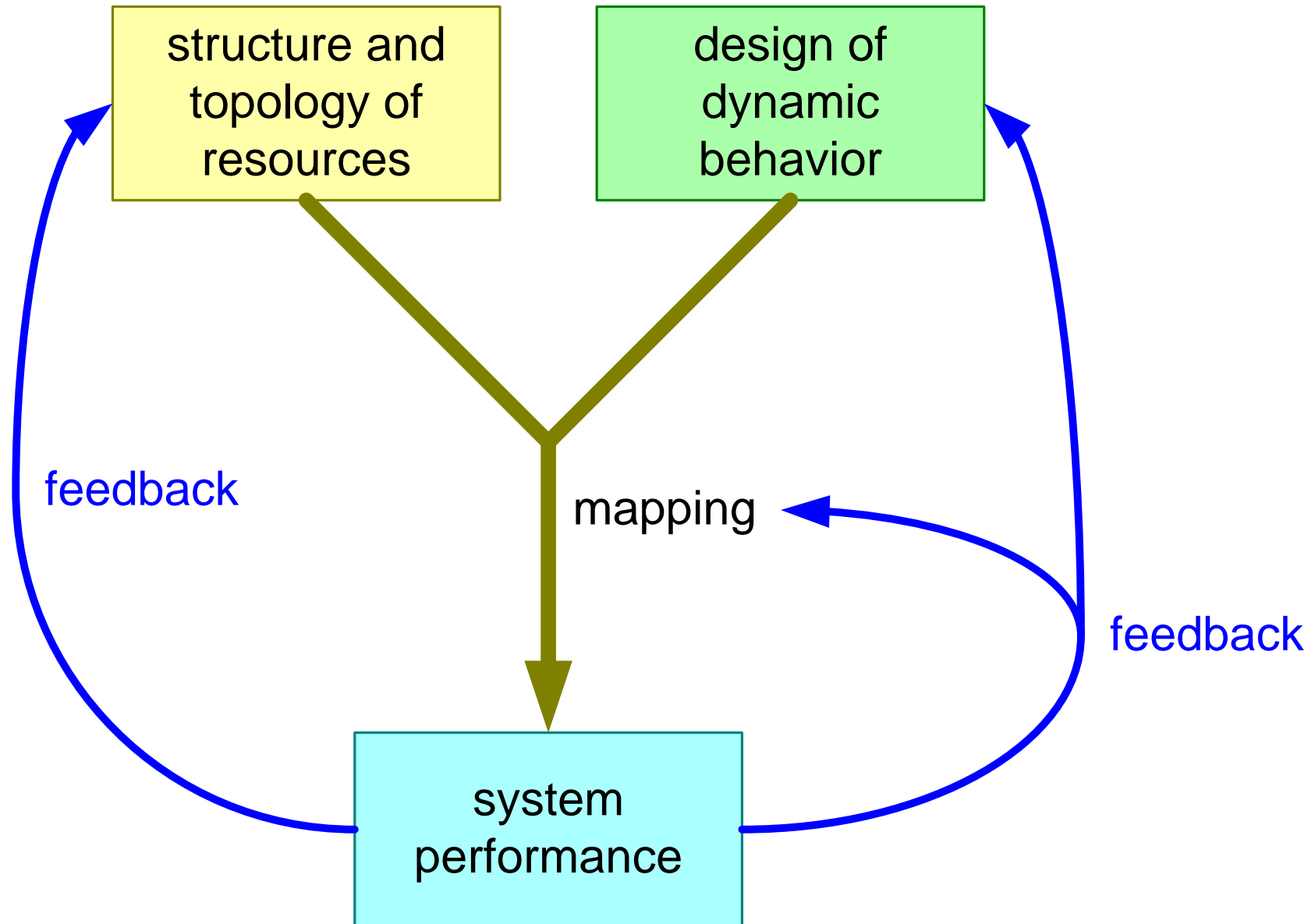


example data storage technology

Pipeline pattern



Y-chart Pattern



Performance Pitfalls and Resource Management

Overhead (control, handling)

Starvation (underrun)

Saturation/stagnation (overrun)

Variation (duration, quality)

Serialization

Interference with other work

Unnecessary conversions or adaptations