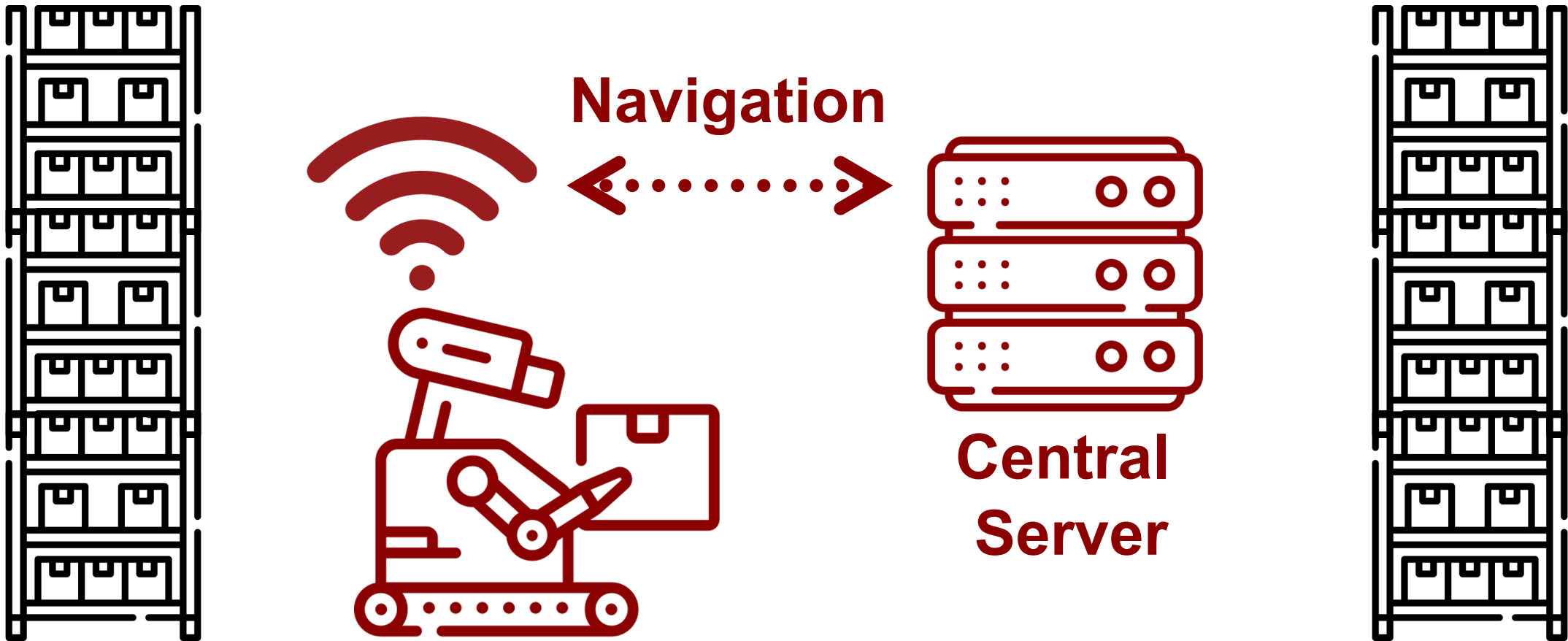


17-723: Designing Large-scale Software Systems

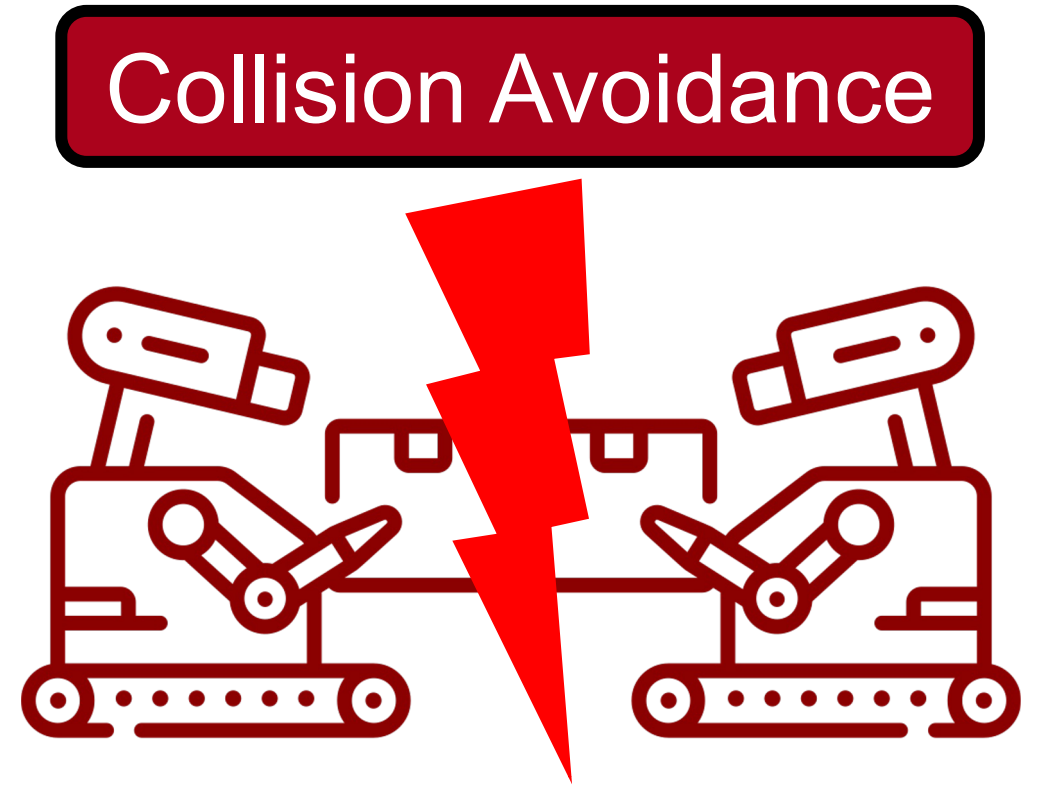
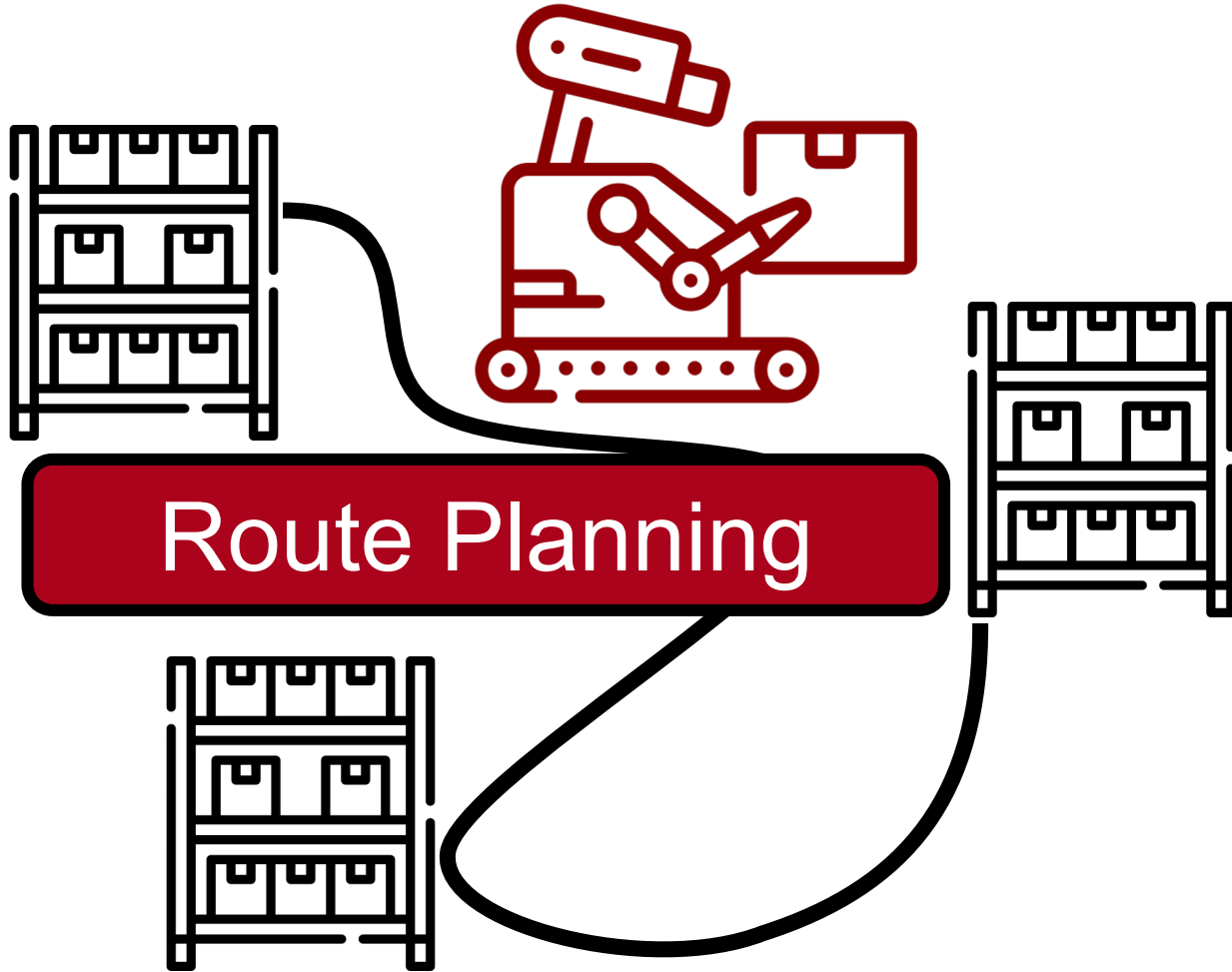
Recitation on Design Tradeoffs

Tobias Dürschmid

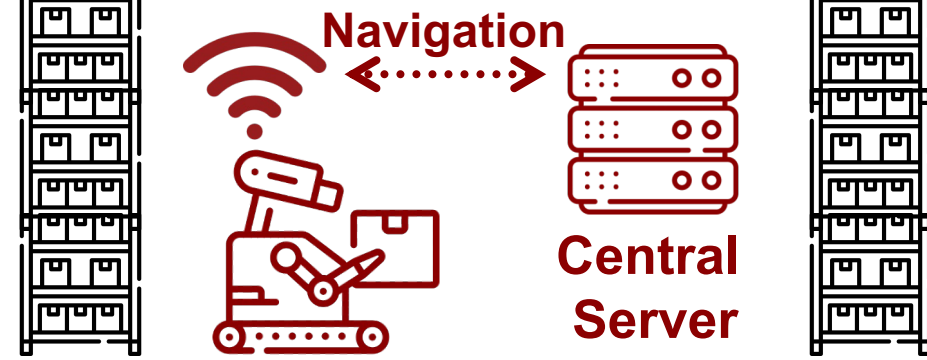
Design A Server-Supported **Robot Warehouse Navigation System**



Design a Robot-Server Communication System that supports **Collision Avoidance** and **Route Planning**



What **Requirements** are Important?



Robustness

The robot should **be able to operate safely** even if the **network is unavailable**.

Changeability

Updating robot software should be possible without a robot hardware connection.

Scalability

Adding new robots to the system should not degrade individual robot performance.

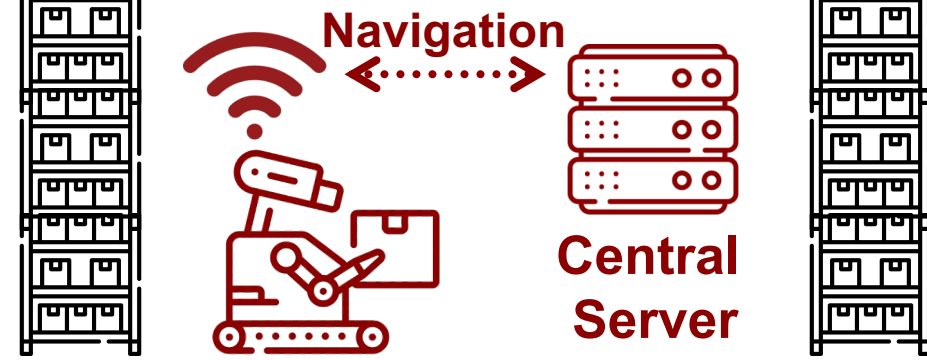
Cost

The **hardware** and **operating** cost of robots, network, and server should be minimal.

Implementation Effort

The effort to implement **robot** and **server software** should be minimal.

What **Models** Do we Need to Communicate the Design?



Robustness

Sequence Diagram

(of robot behavior during unavailable network)

The robot should be able to operate safely even if the network is unavailable.

Changeability

Interface Description

(of robot software update API)

Updating robot software should be possible without a robot hardware connection.

Scalability

Up to YOU!

Adding new robots to the system should not degrade individual robot performance.

Cost

Hardware Annotations

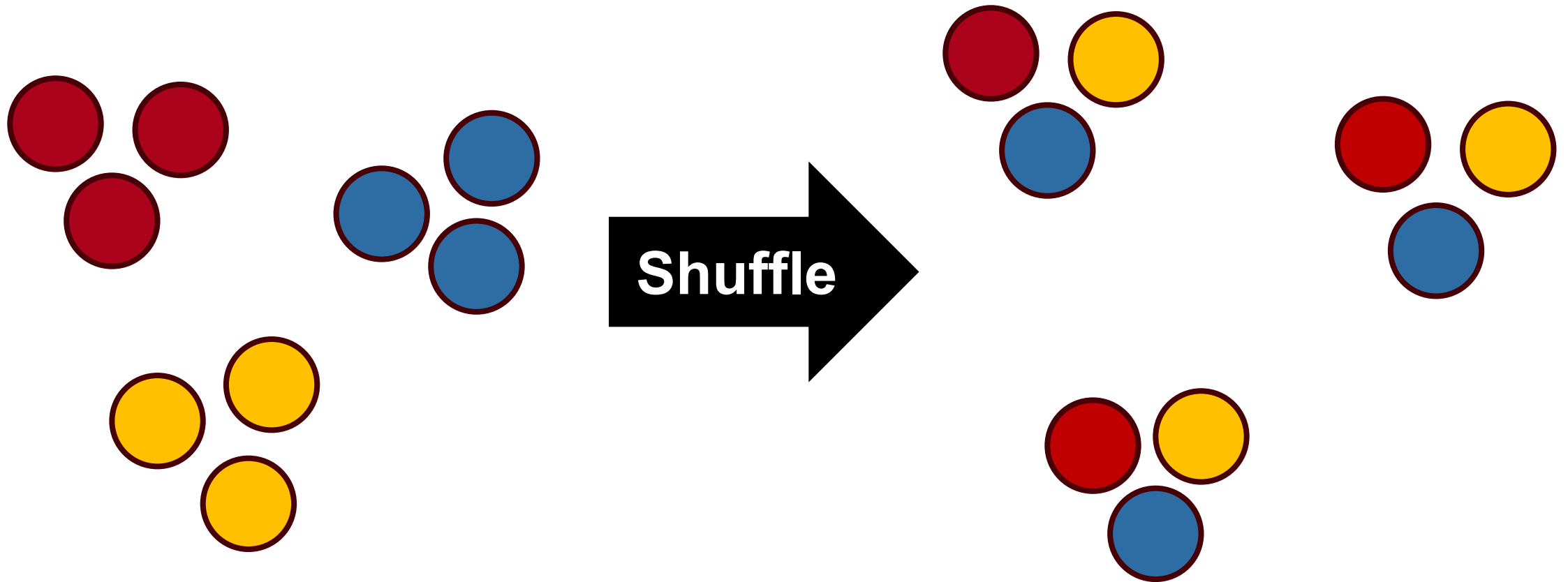
The hardware and operating cost of robots, network, and server should be minimal.

Implementation Effort

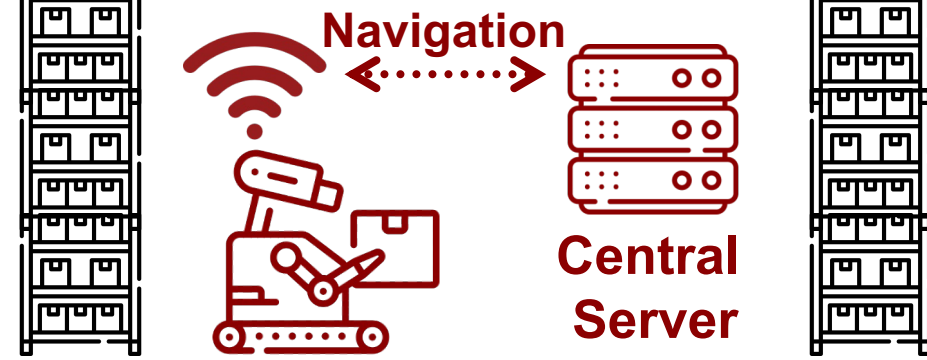
CRC Cards / Component Diagram

The effort to implement robot and server software should be minimal.

Shuffle the Groups to Review your Designs



What **Models** Do we Need to Communicate the Design?



Robustness

Sequence Diagram

(of robot behavior during unavailable network)

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Hardware Annotations

The hardware and operating cost of robots, network, and server should be minimal.

Implementation Effort

CRC Cards / Component Diagram

The effort to implement robot and server software should be minimal.

Summary

- **Redundancy** (separate navigation software on the robot side) / **Graceful Degradation** can be used to ensure **robustness** but increases **implementation effort** and potentially **robot hardware cost**
- **Centralized** navigation on the server-side is **cheaper**, more **changeable**, but less **robust**, and less **scaleable**
- Software update **changeability** is mostly independent of other QAs and can be implemented with a Robot Software Update API (but this can impact security!)