



Auto ID Academic Alliance Meeting

December 2001



Agenda for 10.30-11.15

Project Research Overview

Duncan McFarlane

Current Research on Tags etc

Sanjay Sarma

Auto ID Control Systems Challenges

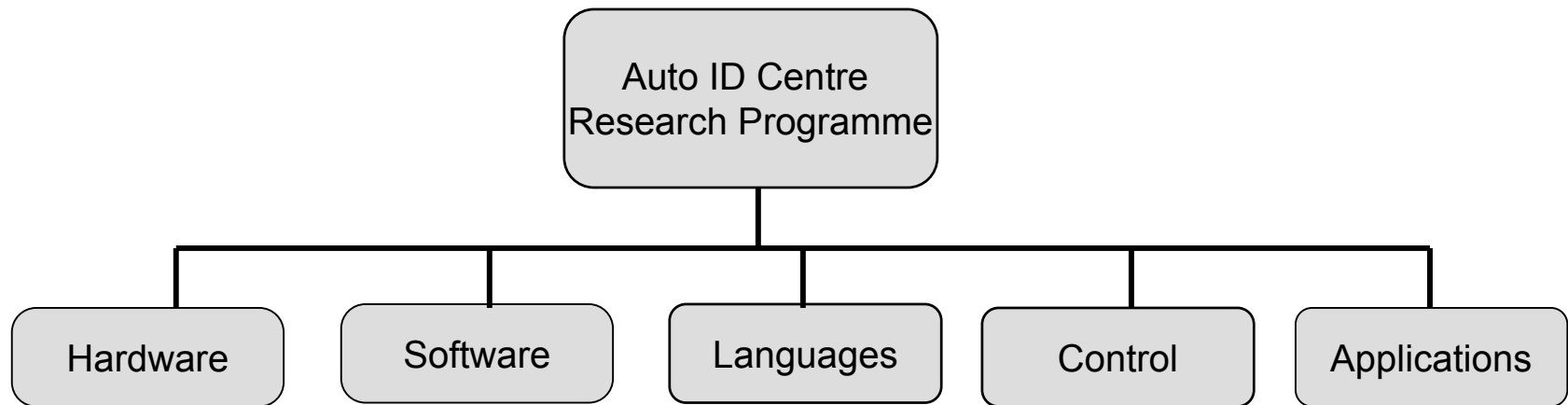
Duncan McFarlane



Auto ID Project Research

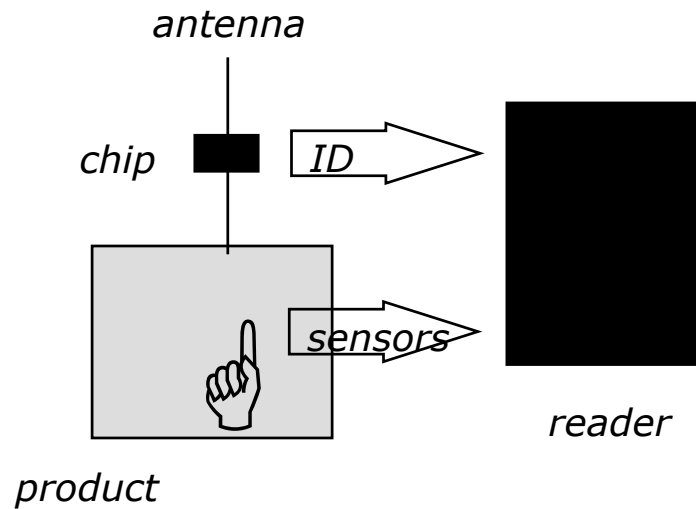
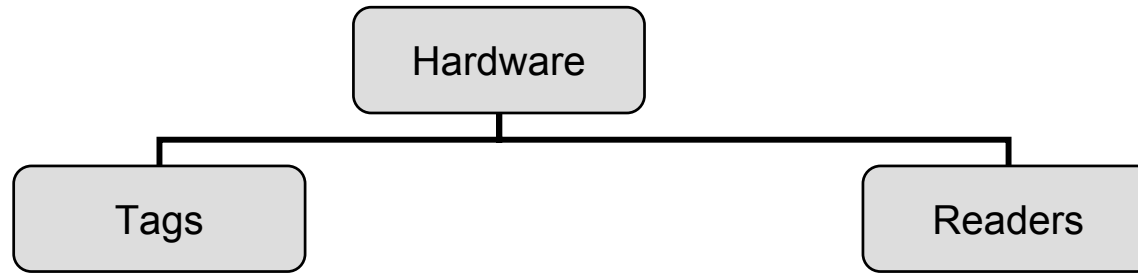


Auto ID Project Research Overview



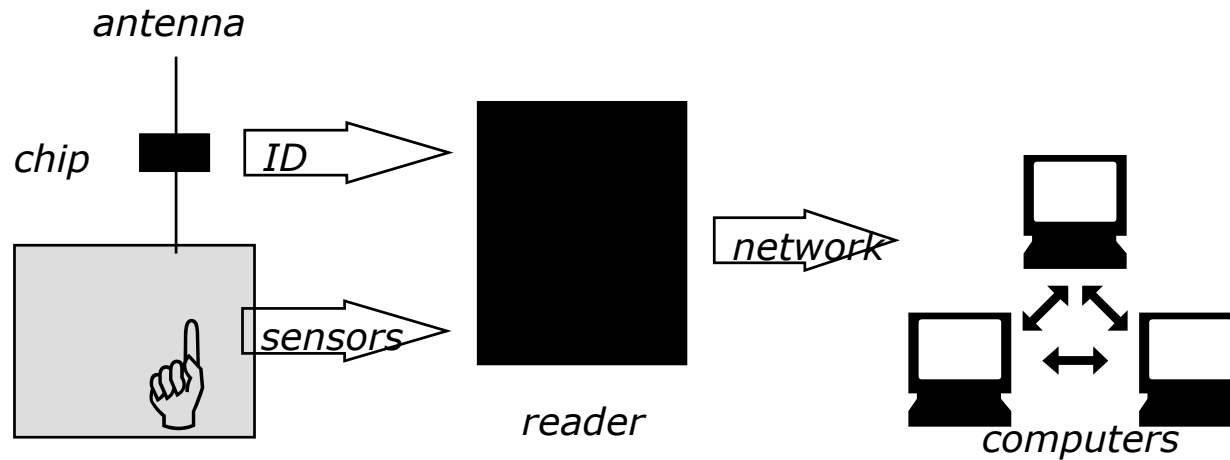
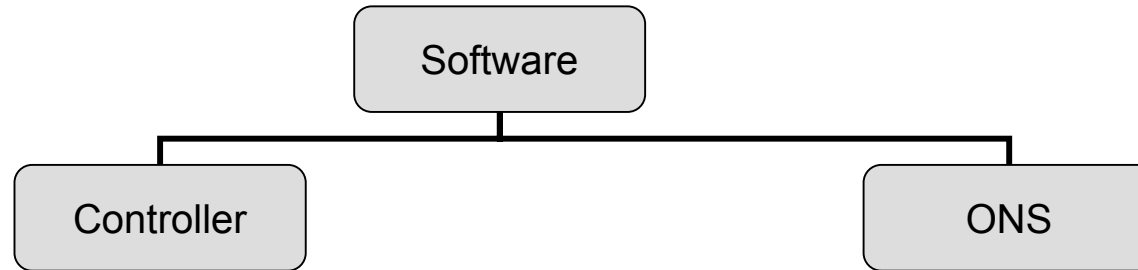


Hardware Research



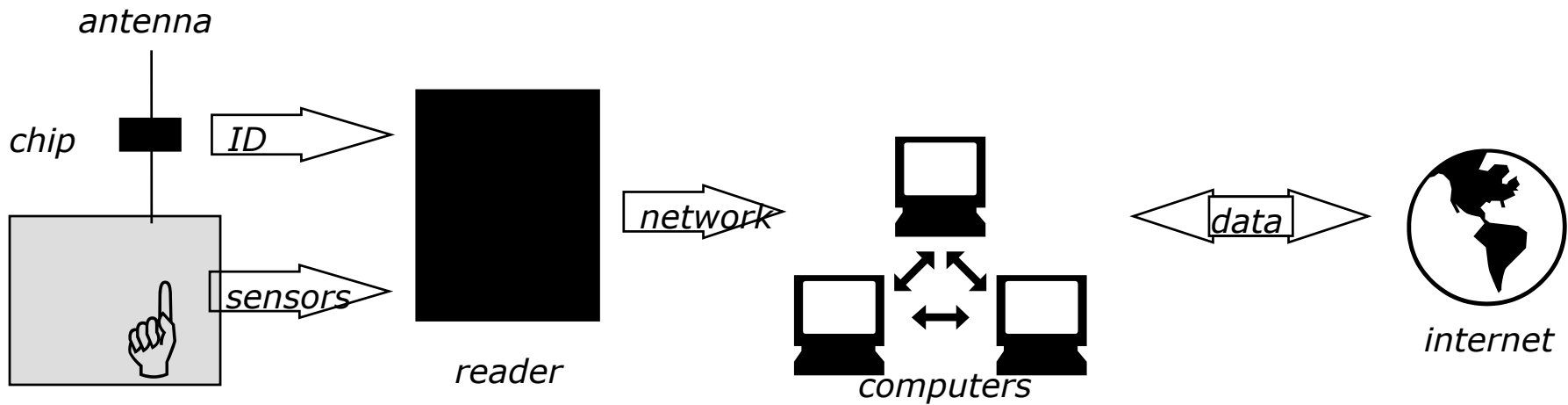
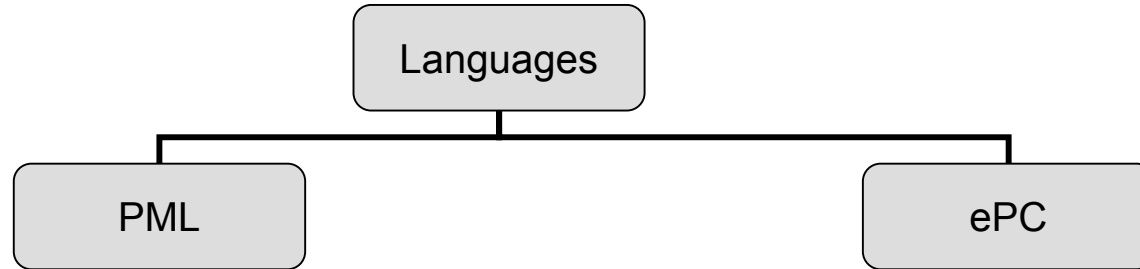


Software Research



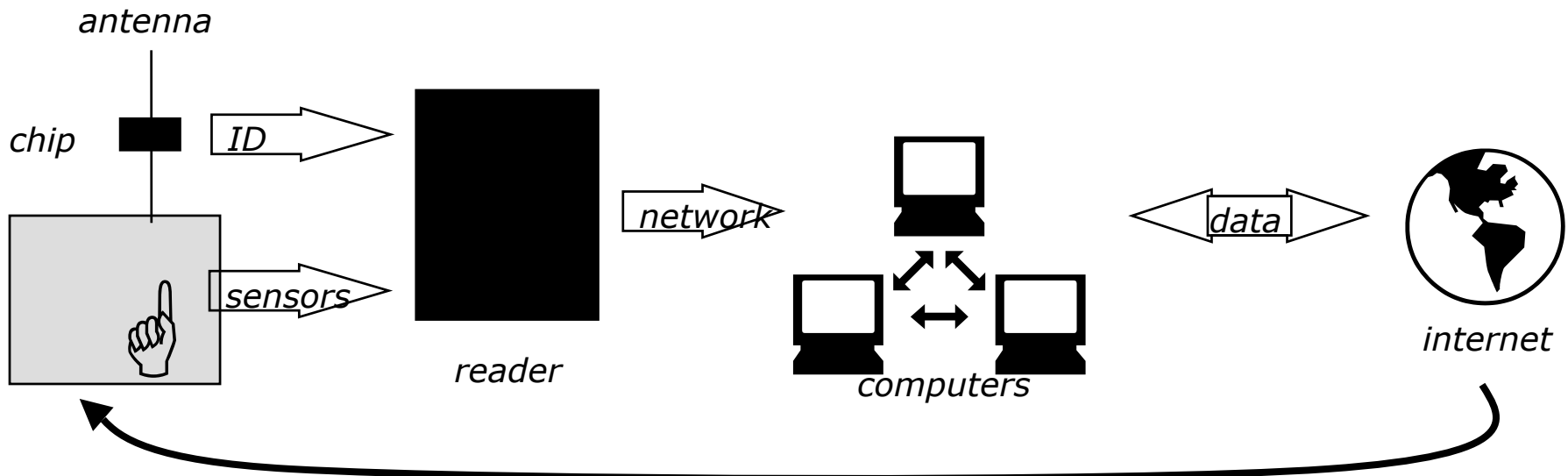
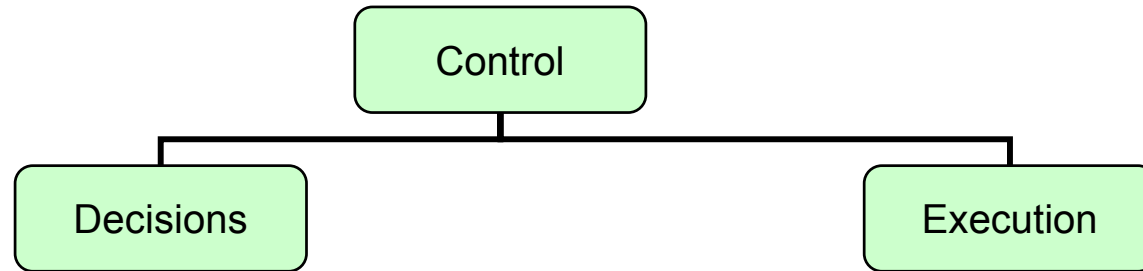


Languages Research



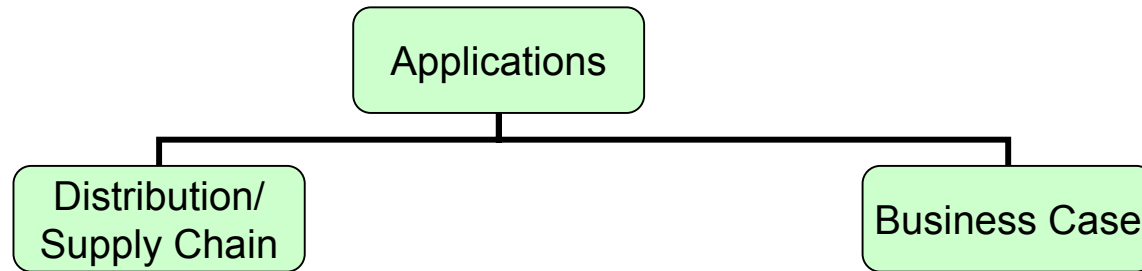


Control Research





Applications Research





Distributed Intelligent Control



Auto ID Research Orientation

Information Oriented

- primarily oriented to collection and analysis of ePC data
- “passive”, open loop systems with one way flow of data
- solutions linked to improving accuracy, efficiency and availability of existing systems
- likely to represent the first roll out of Auto ID based products
- benefits in cost savings



Control Oriented

- primarily oriented towards (automated) decision making on the basis of ePC data
- “active”, closed loop systems with multi directional flow of data
- solutions linked to the re-engineering of existing systems
- second phase of Auto ID roll out
- benefits from value adding





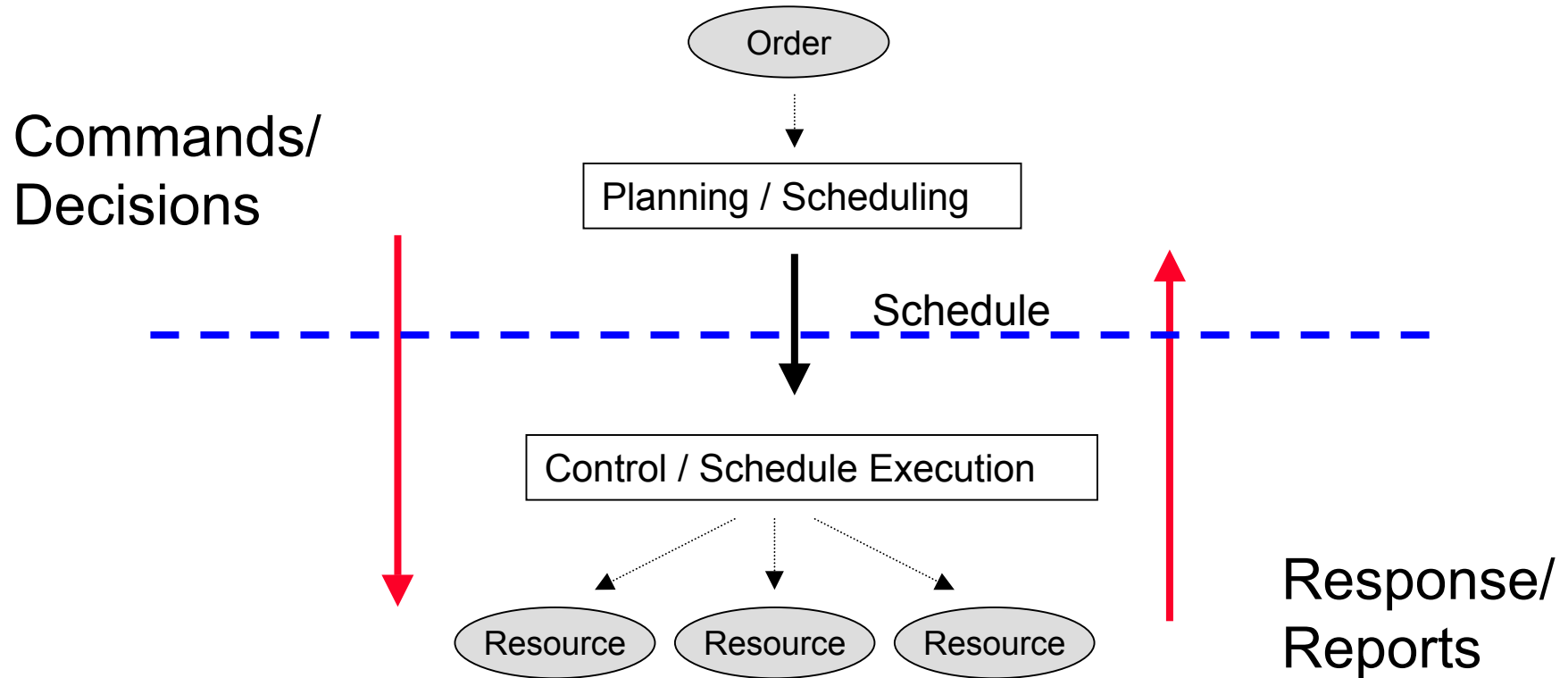
Scope

Focus: interface between decision making and physical operations (execution)

Range: production, distribution, inventory management, retail systems, home appliances ...

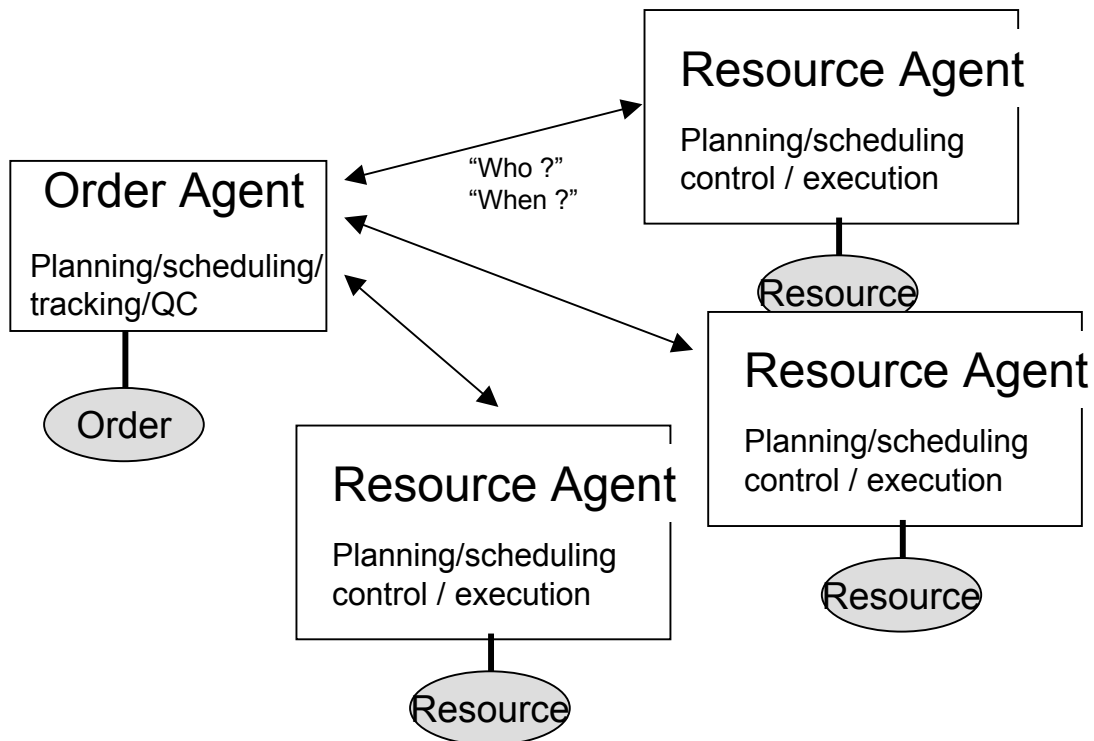


Conventional Control





Distributed, “Intelligent” Control



- **Distributed** software systems (agents) represent manufacturing entities like orders and resources
- agents are **intelligent** capable of reasoning, decision-making and interacting/ “talking” to each other
- decisions are **directly linked** to entities executing the decision (*empowerment*)



Distributed, “Intelligent” Control

BENEFITS

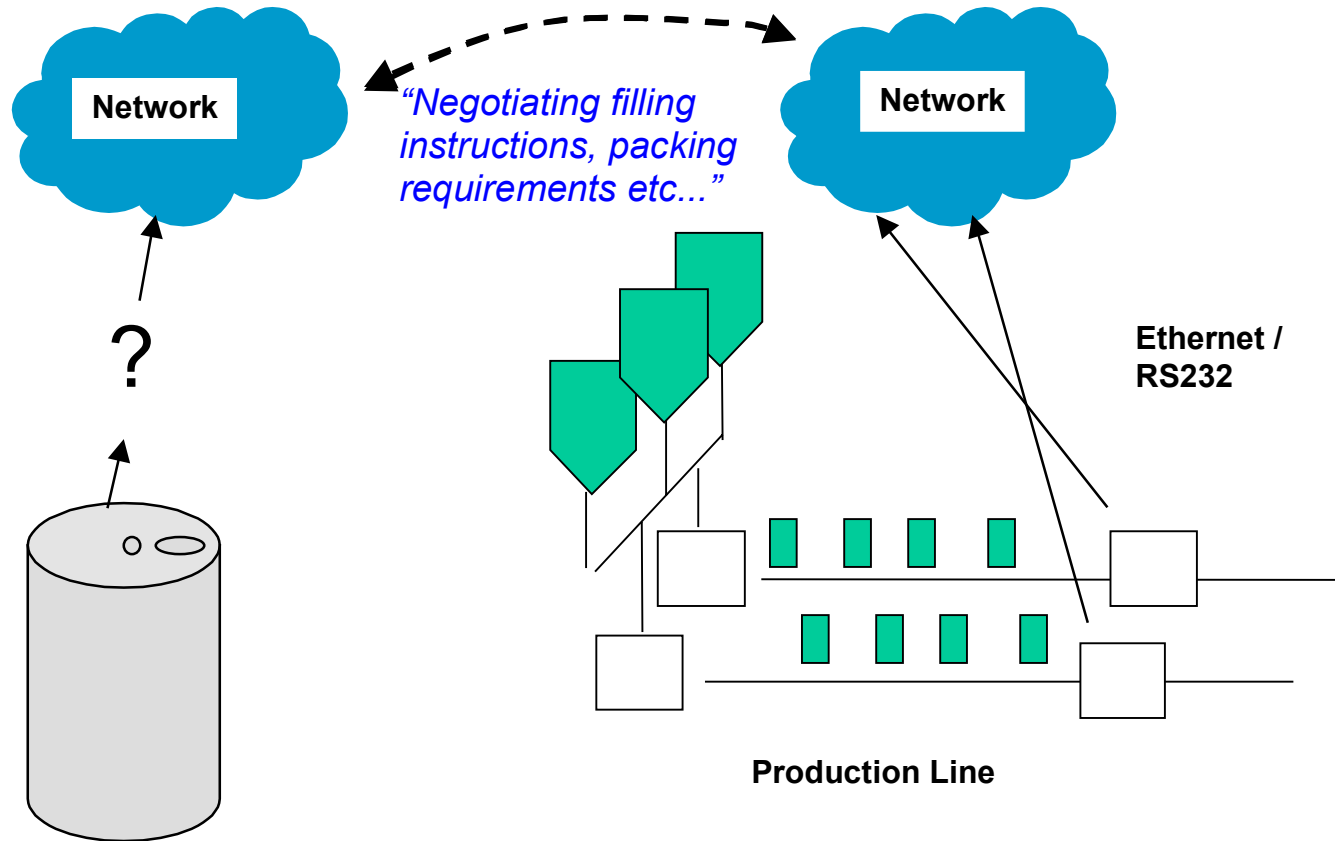
- simpler, cheaper to maintain
- supports more flexible operating environments (product variety, production systems)
- adapt in the face of disruptions
- simpler to reconfigure

COMPLEXITIES

- dynamically monitoring resource capabilities, availabilities (no precommitments)
- guaranteeing resource coordination
- **synchronising physical product/part movements with “intelligent” software**



Typical Production Line

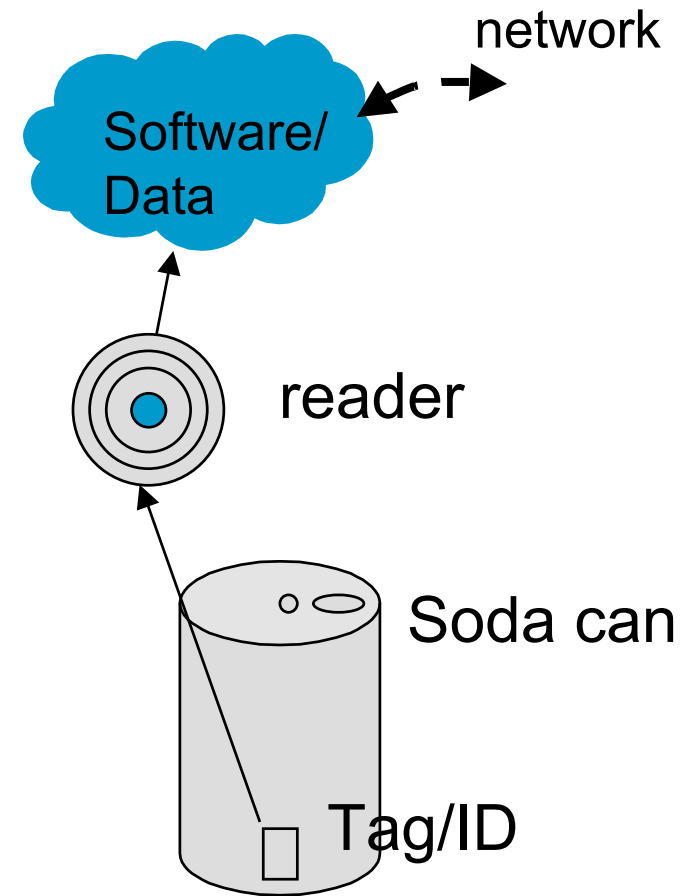




Intelligent Product

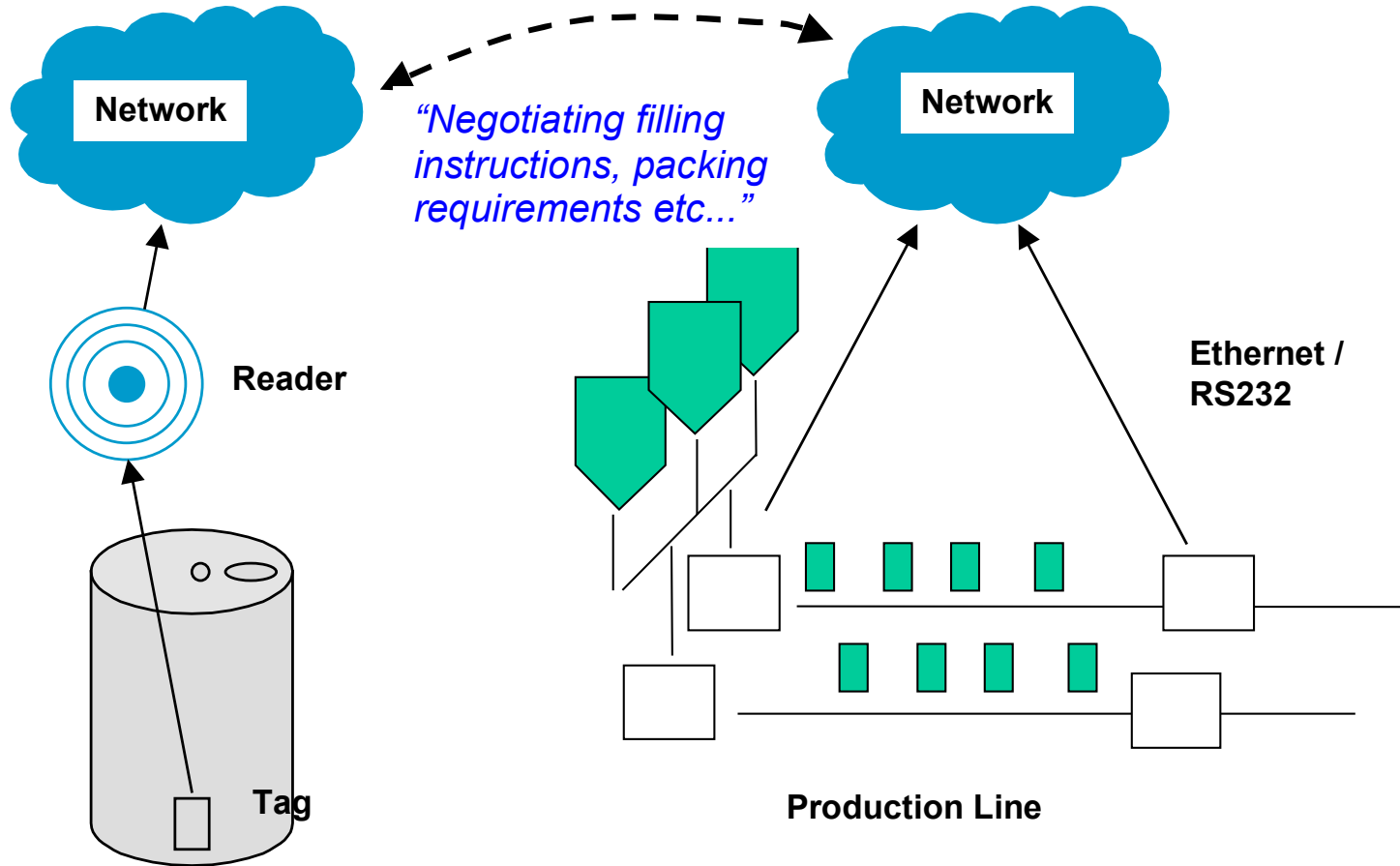
A physical and/or information based representation of an item for retail which:

- (1) possesses a unique identification
- (2) is capable of communicating effectively with its environment
- (3) can retain or store data about itself
- (4) deploys a language to display its features, production requirements etc...
- (5) is capable of participating in or making decisions relevant to its own destiny



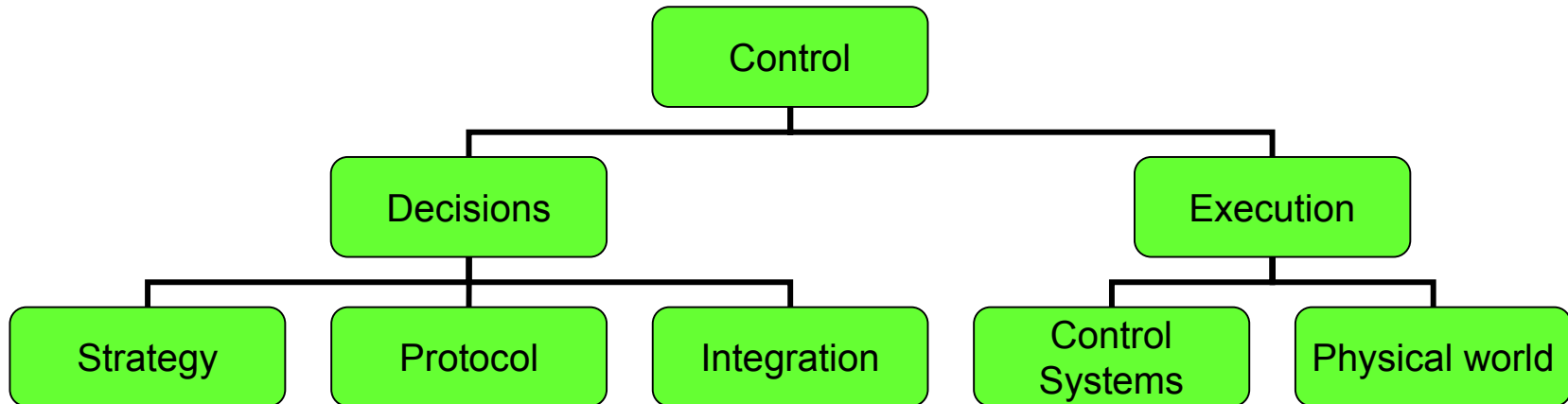


Auto ID Enhanced Production Line





Control Research





Research Overview

Decision - *the generation and resolution of issues encountered by auto-id based products in their manufacture, distribution, retail, use and disposal*

Strategy - *Underlying rule(s) used to guide and resolve automated decisions which use auto-id and other information*

Protocol - *Mechanisms for managing distributed communications such that strategies can provide a distributed solution.*

Integration - *Alignment of auto-id based information with industrial decision making and information systems*



Research Overview

Execution - *methodologies for the carrying out of auto-id based decision outcomes*
e.g. execution of schedules, inv. Management, distn policies

Control System - *Underlying rule(s) used to guide and resolve automated decisions which use auto-id and other information*

Physical System - *Design and operation of physical systems so that they best exploit advantages provided by auto-id capabilities*



Control Research Issues

Fundamental

- embedding distributed control into auto id based systems
- (distributed) adaptive control/dispatching/scheduling solutions
- (robust) stability/performance analysis of auto id driven control
- part / order driven control processes
- demonstrated implementations
- hardware/software implications
- location!
- compatibility with legacy environments (migration)



Control Research Issues

Domain Oriented

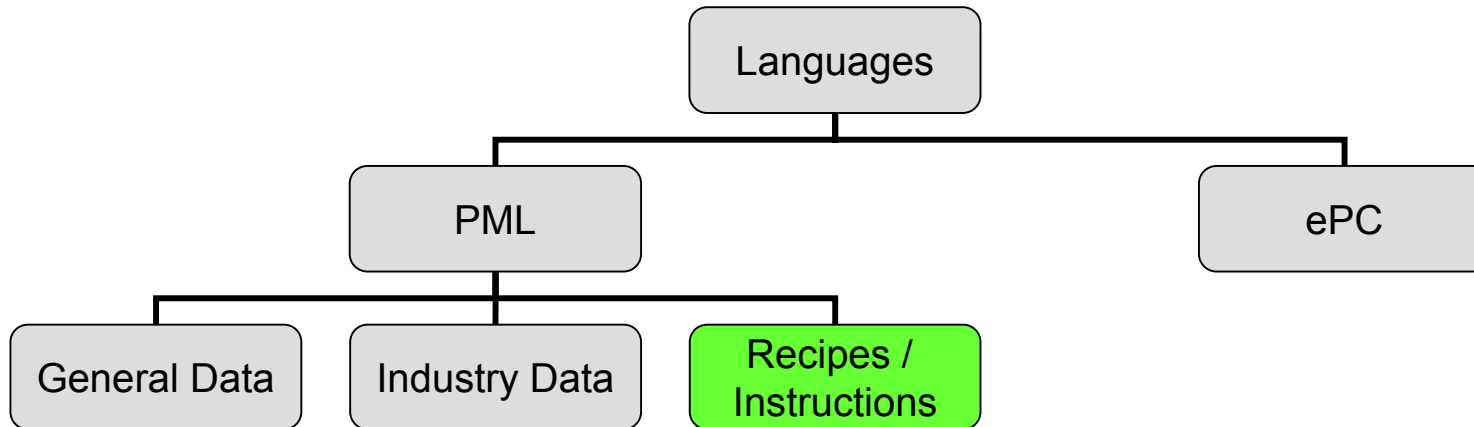
- aggregation / disaggregation of tagged parts
- rationale for tagging all/some/one part in a product
- implications for flexible control / dynamic dispatching/scheduling
- impact on part/product movement & storage / intelligent warehousing
- order driven manufacturing
- embedded control
- product life cycle management



Control Languages



Languages Research





Recipes / Machine Instructions

*A set of parameters, tasks, sequences, decision points
which describes a transformation of one or more products*

Recipe: Product Oriented, Resource Independent

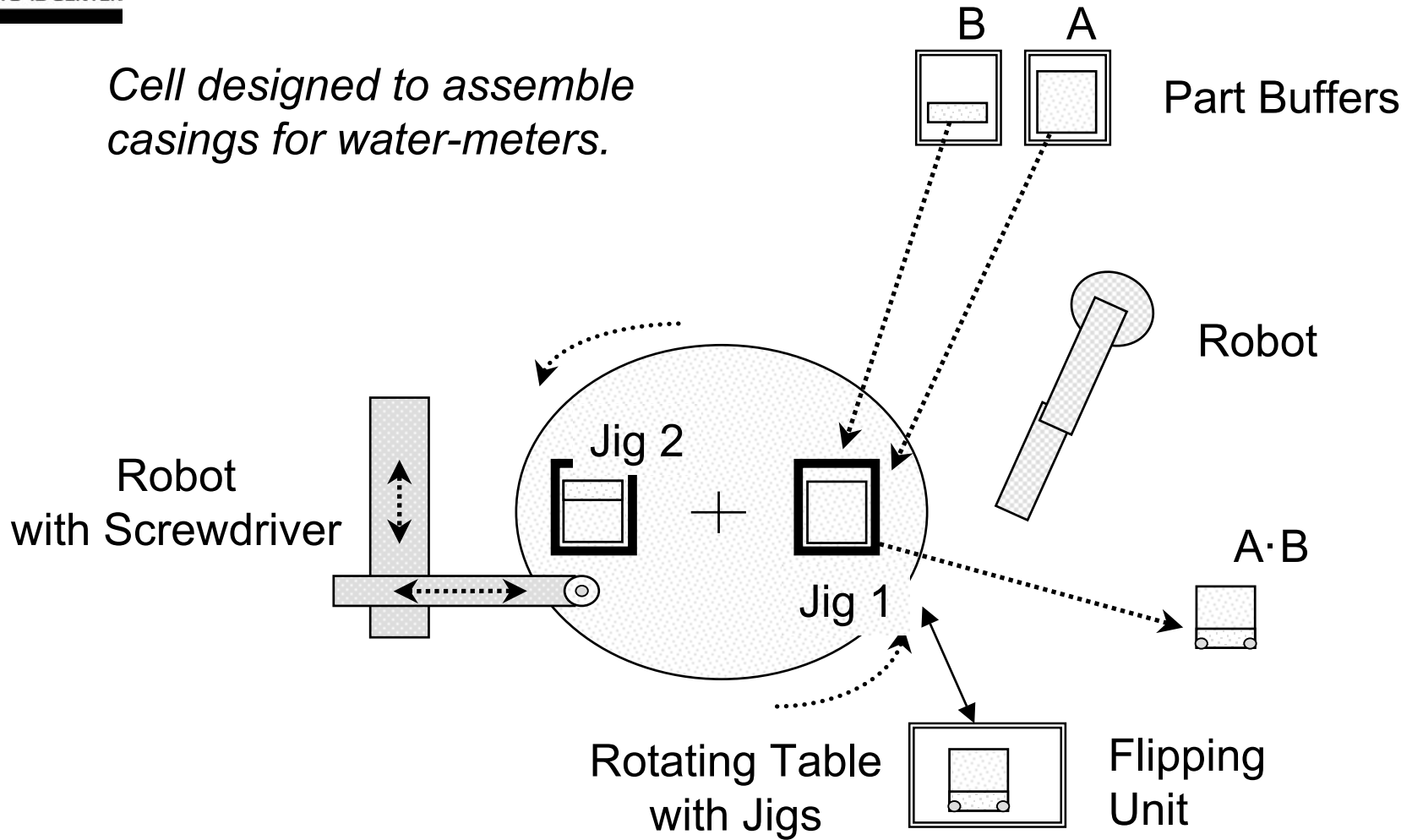
Machine

Instruction: Resource Oriented, Resource dependent



Example 1: Intelligent Assembly Cell

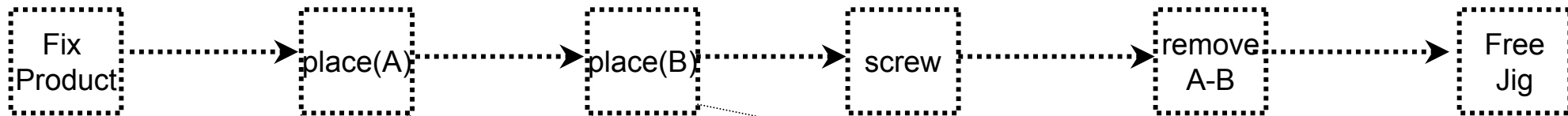
Cell designed to assemble casings for water-meters.



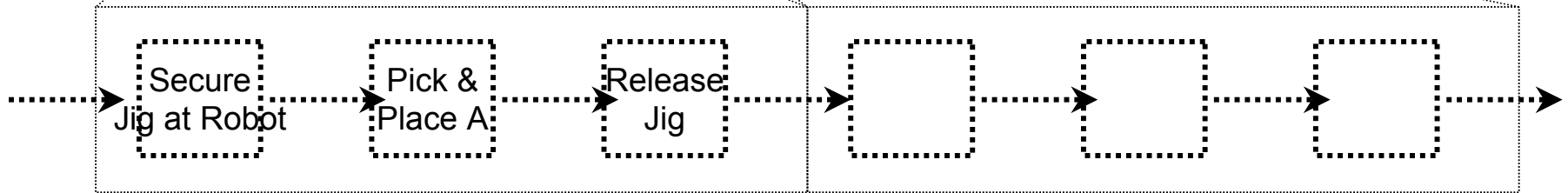


Assembly Recipe / Machine Instructions

Part Processing Sequence or Recipe (Resource Independent)

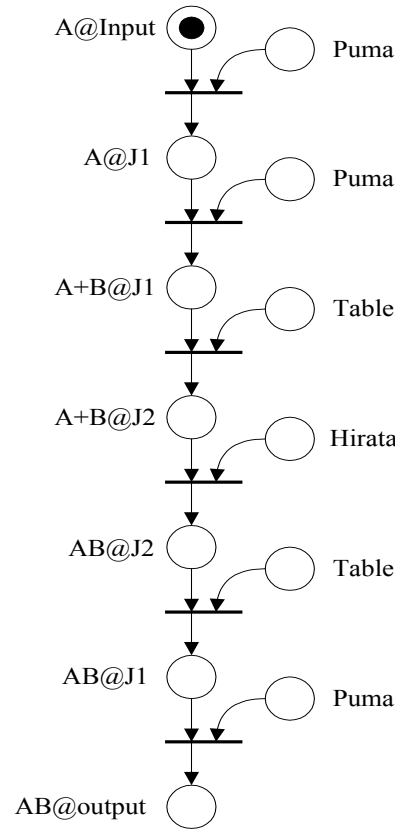


Resource Based Production Sequence

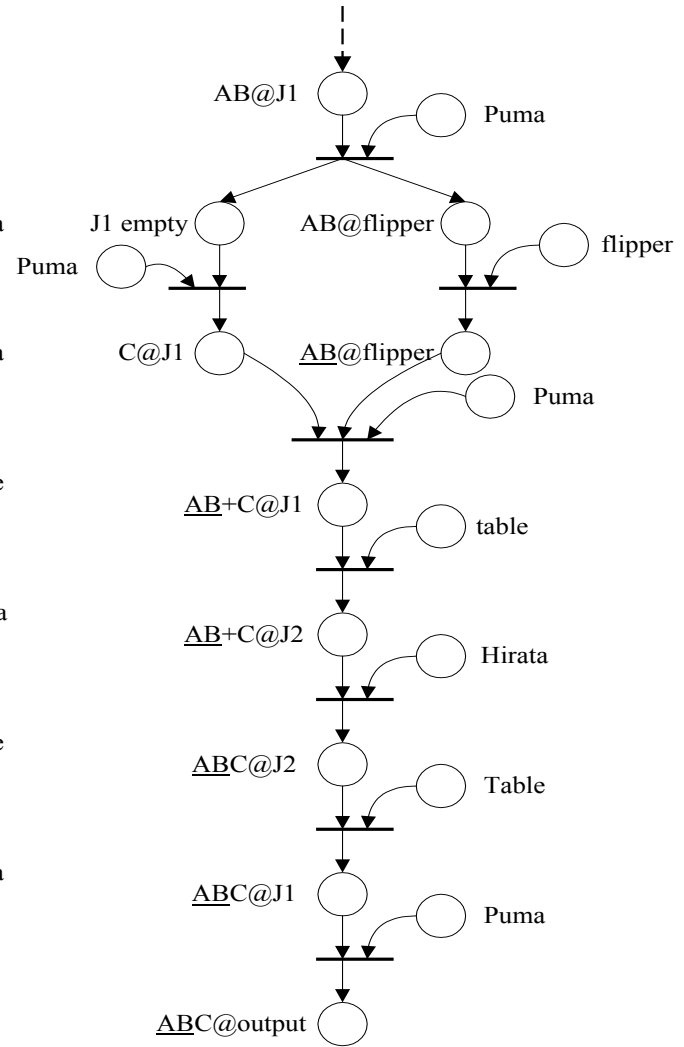




Resource Dependent Instructions for Products AB, ABC



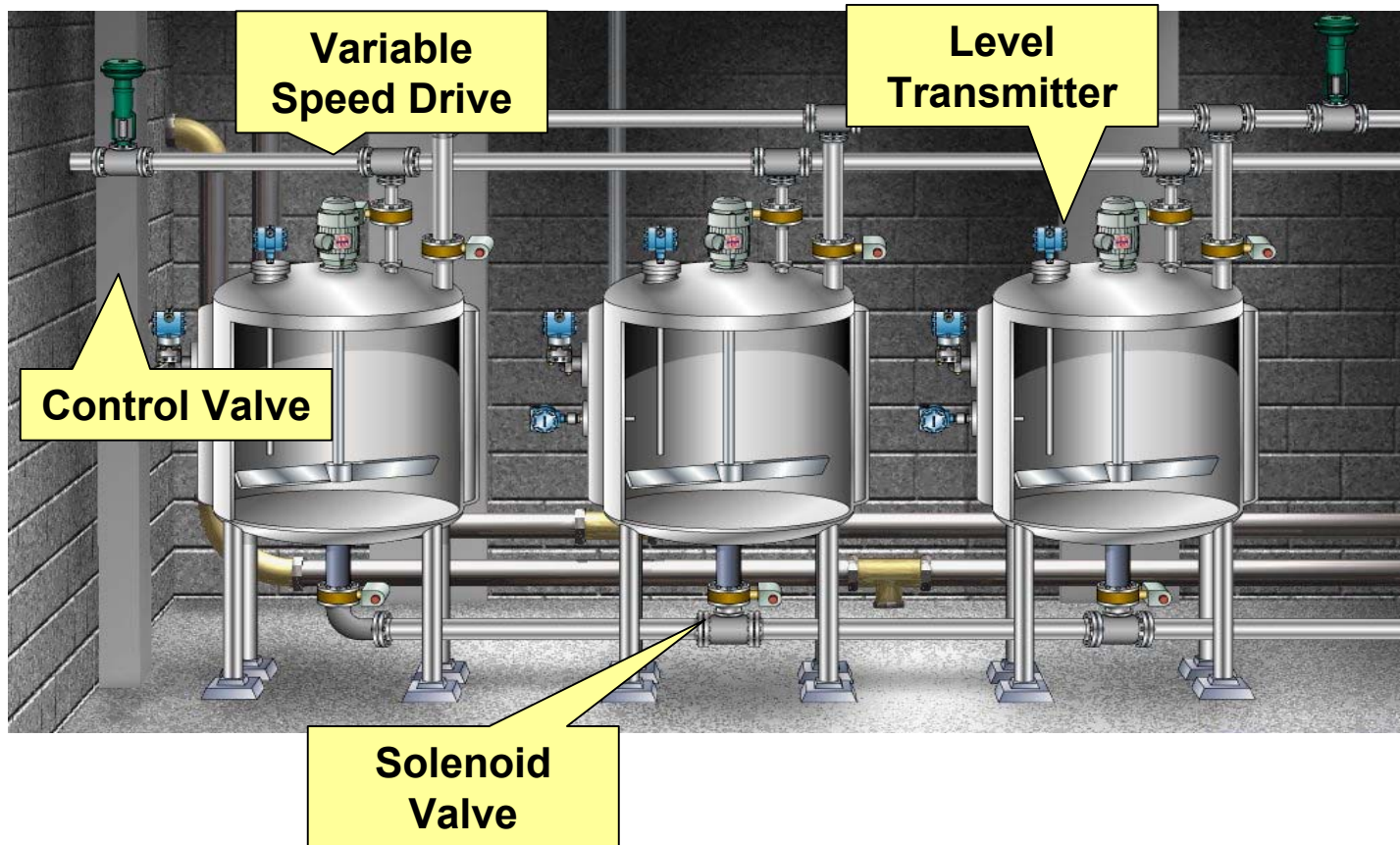
(Product AB)



(Product ABC)

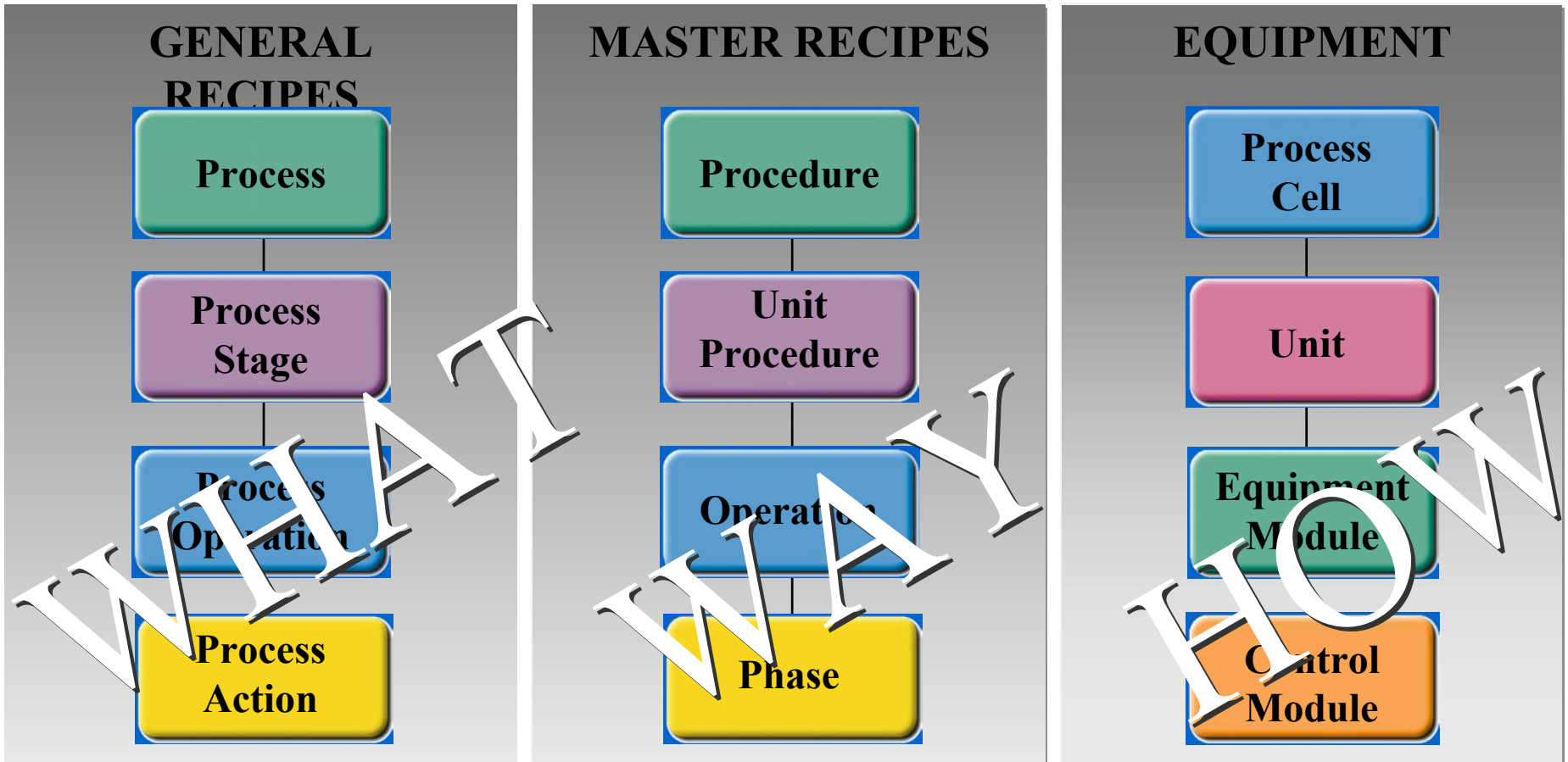


Example 2: Batch Processing





Batch Production Recipes - S88



Source: A McDonald, Unilever



Example 3: Domestic Application



Recipe

heat to 60 deg C ?
cool for 3 mins ?

Cook me
How long?



Machine instruction

10 mins @1000 watts
rotate @ 2 rps

.....



Language Research Issues

- Generic recipe structures and formation
 - Compatibility with Existing Standards - S88, Rosetta Net
 - Compatibility with Existing Data Structures
 - Development in line with PML
-
- Interfacing between recipes and machine capabilities
 - Automated handling of multi-operational routes
 - Managing recipes in intelligent control environments



Simple Demonstrator



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