

Modelling the Multi-Faceted Purpose of Artefacts

*International Workshop On Utility, Usability and Complexity
of Emergent IS*



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Towards Purposeful Systems?

*“The hardest single part of building
a software system
is deciding precisely what to build”- F.Brooks*

Towards Purposeful Systems?

- ◆ **Poor requirements are major source of failures (Standish 95) 8000 projects, 350 US companies : 1/3 of projects never completed & 50% succeeded only partially**
- ◆ **Most perceived problems are related to requirements specification (>50%) - (ESI96) : 3800 organisations in 17 European countries**

Requirements Engineering

- The WHY question

Why the system needs to be developed?

- The WHAT question

What the system shall do?

« Requirements definition must say

- why a system is needed, based on current or foreseen conditions,
- what system features will satisfy this context,
.....» (Ross77)

IEEE Computer 85, IEEE SE 91-92, Bubenko94, Mylopoulos92,
Dardenne93, Loucopoulos95, Rolland98 etc..

Requirements Engineering



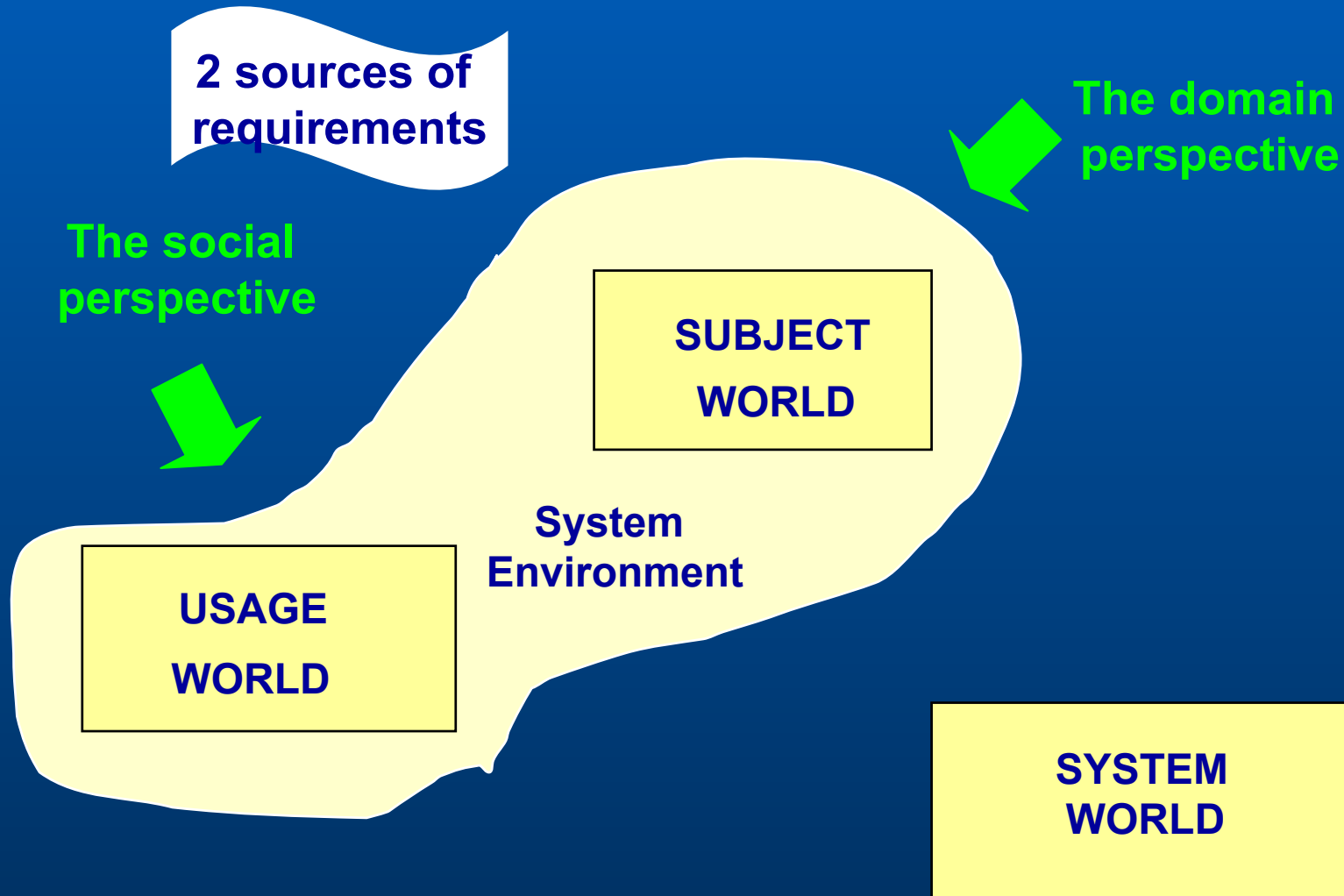
Focusing on the the WHAT question poses problems :

Concentrates on the software functionality specification and not enough on its rationale



Tackling the WHY question gives hope for more purposeful systems to be developed

RE Framework



RE Framework

2 sources of requirements

The social perspective



System Environment

SUBJECT WORLD

USAGE WORLD

Understanding the Intentional Relationship is essential to comprehend the system rationale

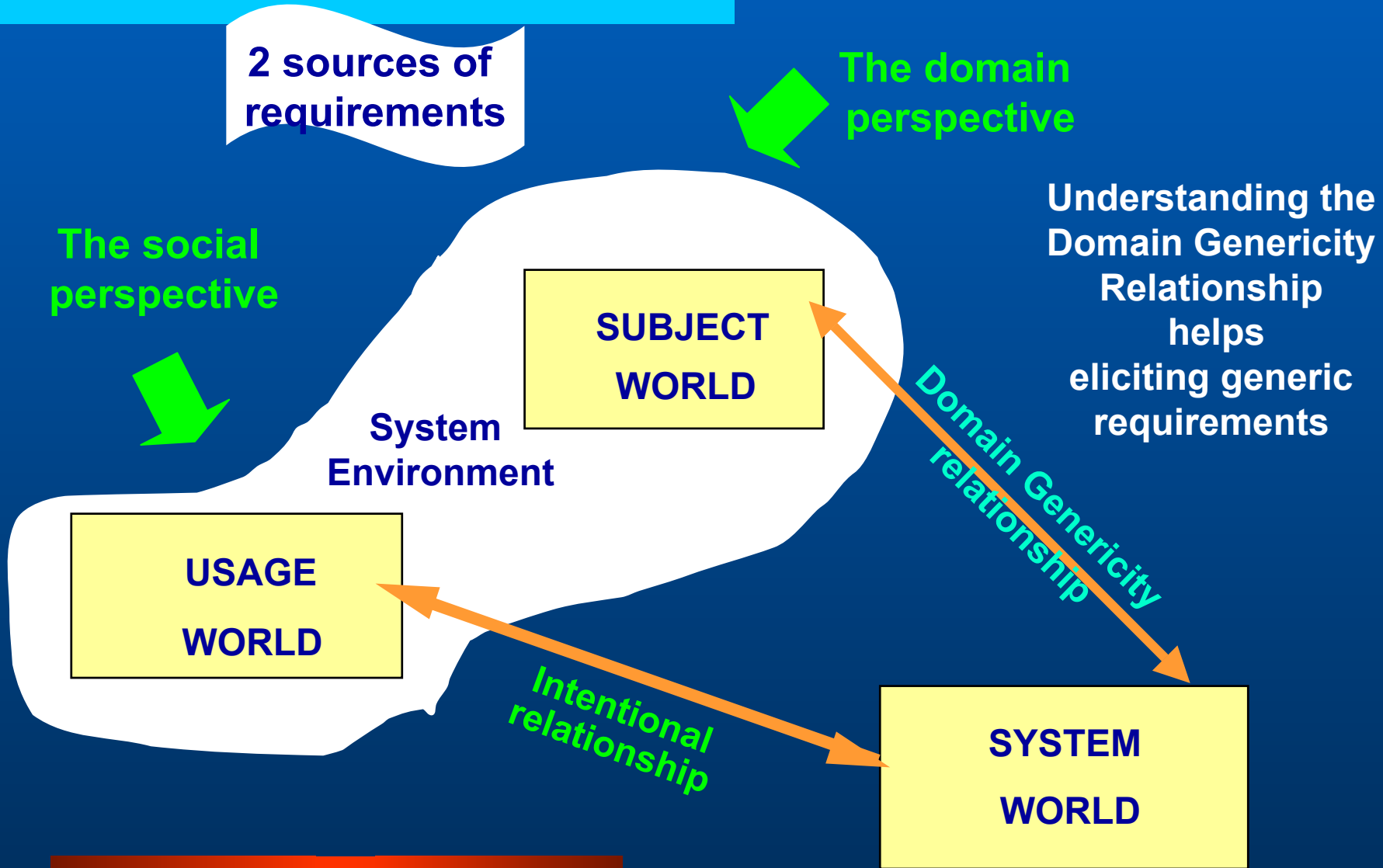
Goal driven approaches

Intentional Relationship

SYSTEM WORLD



RE Framework



RE Process

WHY ?

Mission statement,
goals

Goal
operationalisation

The Requirements
Engineering process

WHAT ?

Requirements
Specification

Goal Driven RE

Goals have useful characteristics

Goals are optative statements (as opposed to descriptive), (Jackson95), expressions of intents

Ex : Transport passengers safely

Assure customer loyalty

- Avoid to deal with details and help focusing of the essentials

Goals can be expressed at different level of abstraction

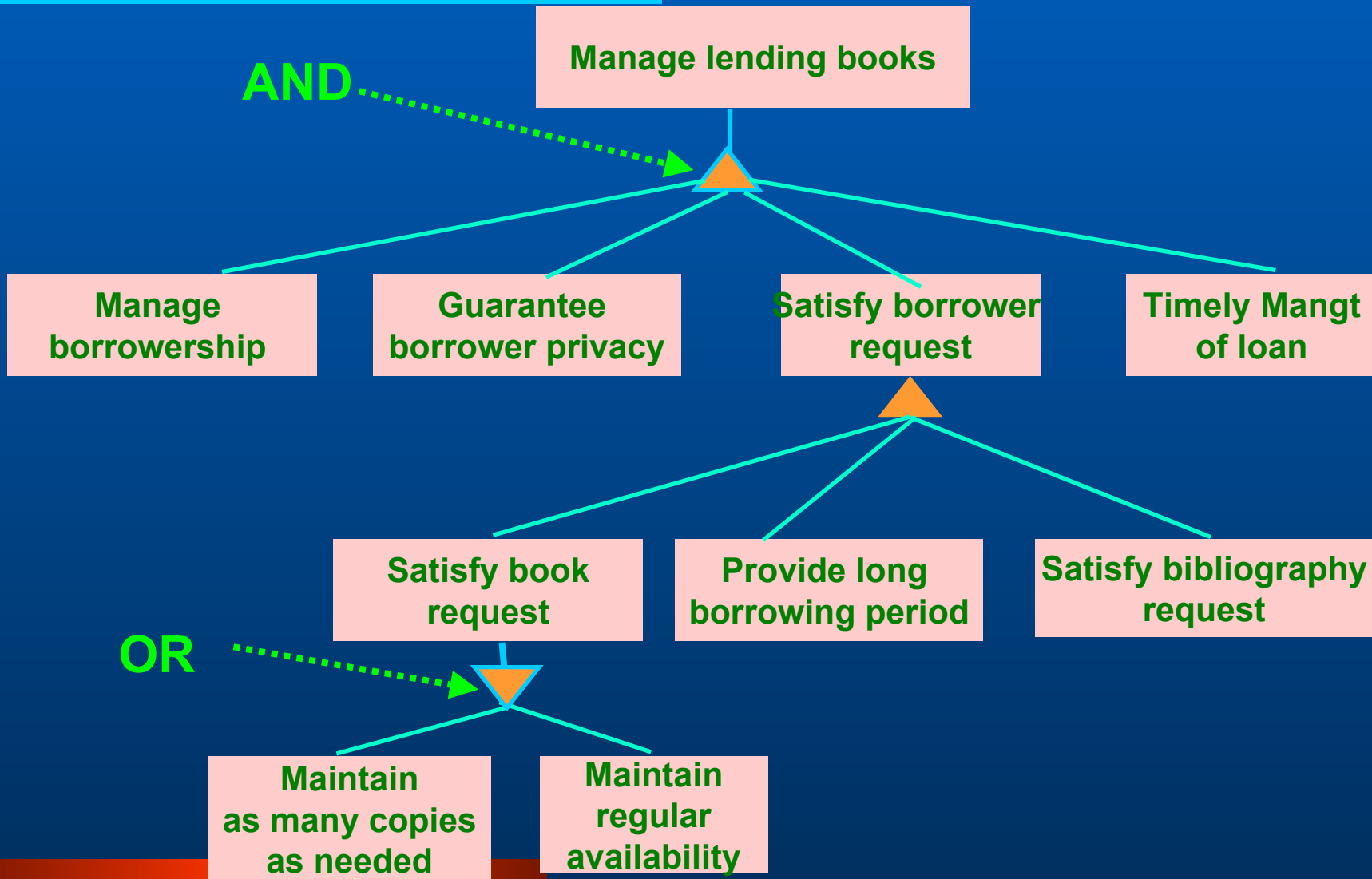
Ex : Keep doors close when moving

Keep record of loyal customers favourites!

- Goals drive the elaboration of requirements to support them

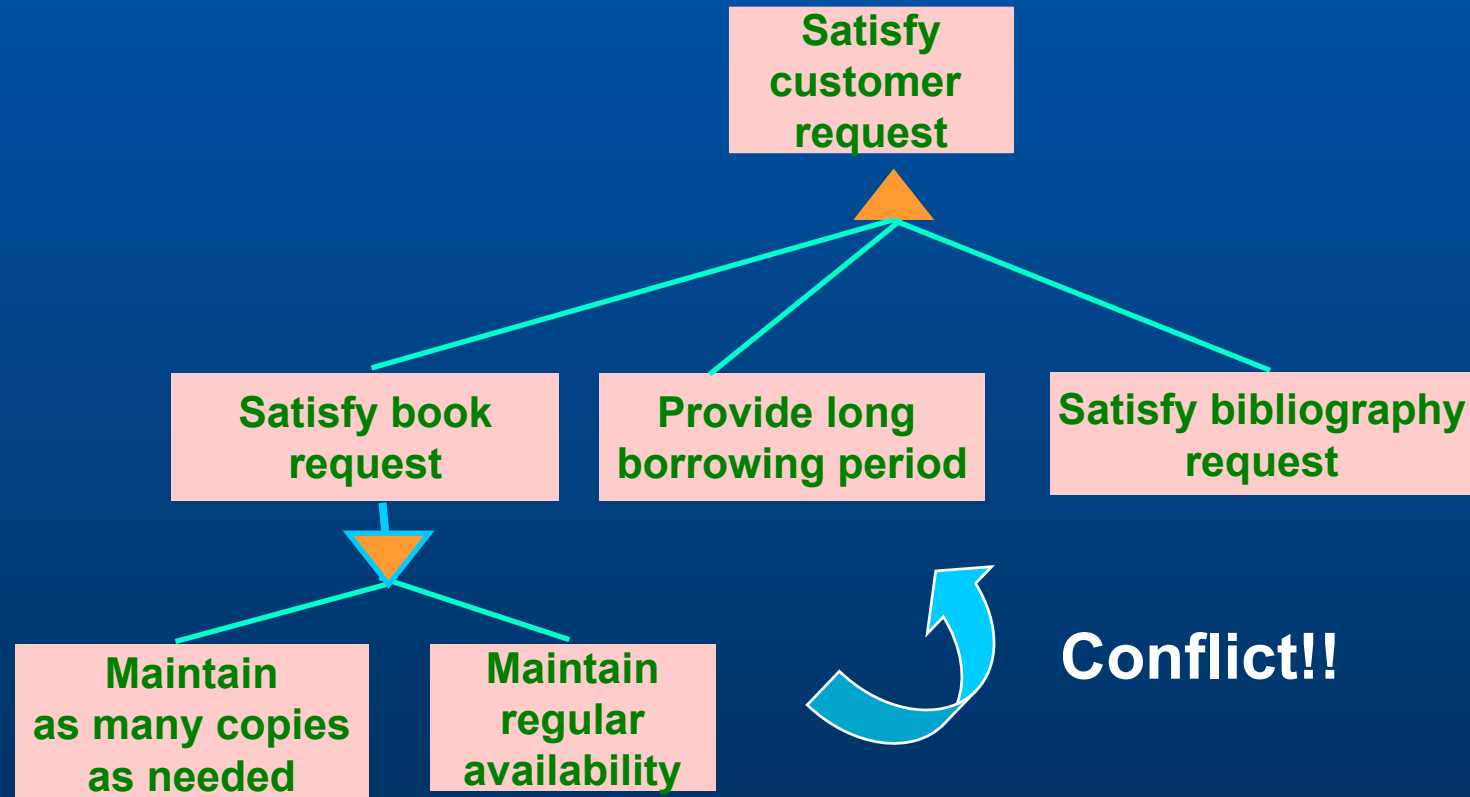
Goal Driven RE

- Goals provide rich structuring mechanism (AND/OR refinement)



Goal Driven RE

- Goals are roots for conflict detection & resolution



Goal Driven RE

Goals proved to play useful roles in RE

- * requirements elicitation
- * exploration of system choices
- * requirements completeness
- * requirements pre-traceability
- * detection & resolution of conflicts
- * documentation
- * negotiation
- * evolution & change

Contributing to the purposefulness of systems

Mono-faceted purpose

Goal



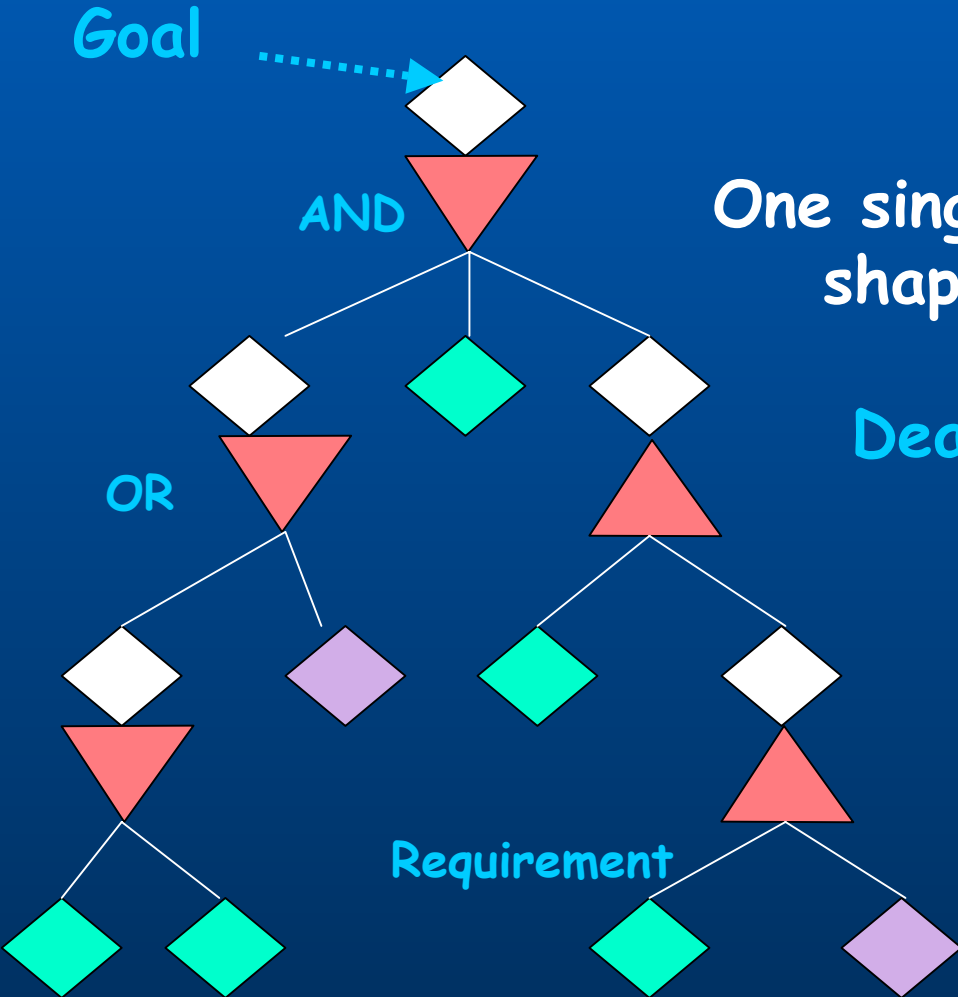
AND

OR

Requirement

Rejected alternative

One single set of requirements (green) shaping one single implemented system functionality :
Dealing with a mono-faceted purpose



Multi-faceted purpose

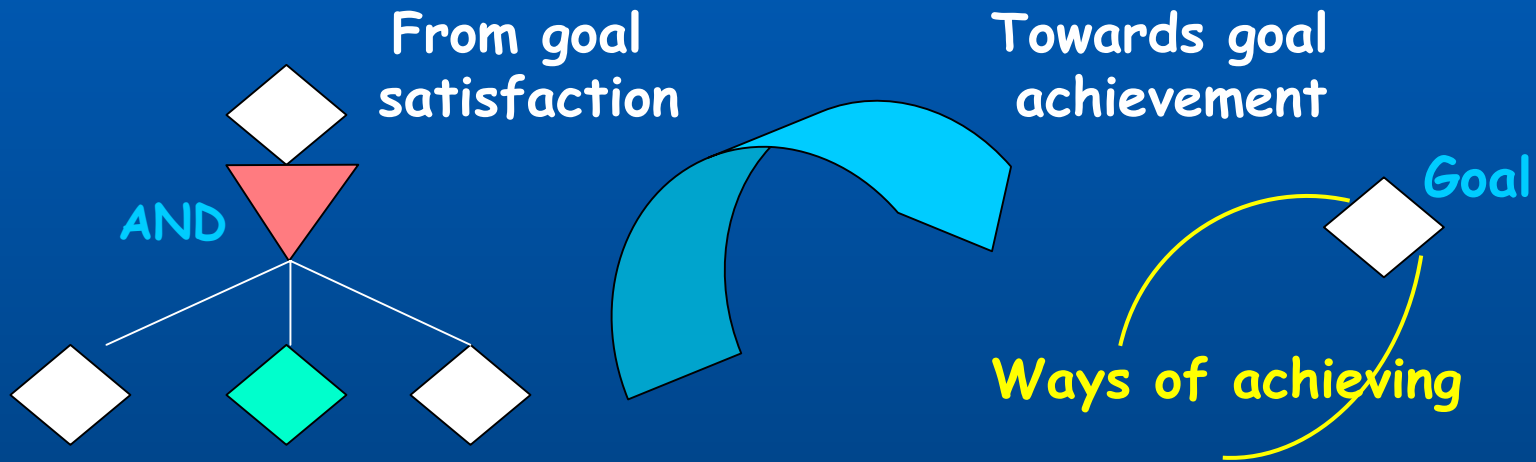
New context of IS product development

From meeting the purpose of a single organisation
and single set of customers

IS products must be conceived to meeting the purpose of **different organisations** and **be adaptable to different usage situations/customer sets**

- ERP systems
- Product-line development
 - Adaptable software
 - Mergers/take-overs
- Alignment of business practice in company subsidiaries

From goal satisfaction towards goal achievement



Several sets of alternative requirements
shaping multiple alternative
system functionalities :
Dealing with a multi-faceted
purpose

Modelling the Multi-Faceted Purpose of Artefacts



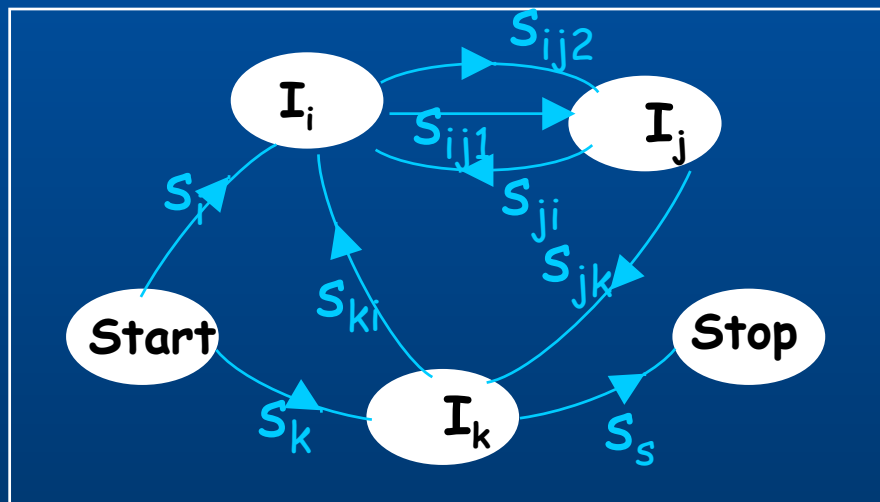
Outline

- Modelling MFP with maps
- Refining facets through map refinement
 - Aligning functionality & purpose
 - Customizing MFP

Modelling MFP with Maps

A Map is a means to represent
as a non-deterministic ordering

Map as a set of interconnected
sections $\langle I_i, I_j, S_{ij} \rangle$ having I_i as
the pre-condition for I_j to be
achieved following strategy S_{ij}



Intention
A goal to be achieved

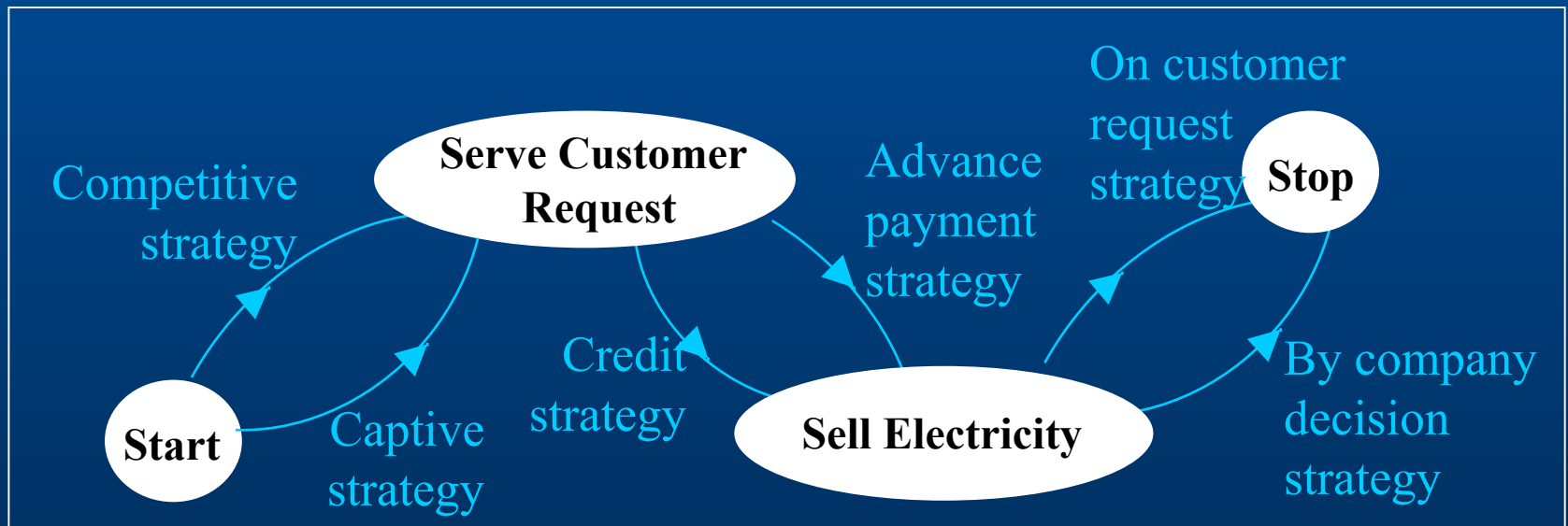
Strategy
A manner to achieve
an intention

An Intention I_i together with a Strategy S_{ki} is a Facet

Modelling MFP with Maps

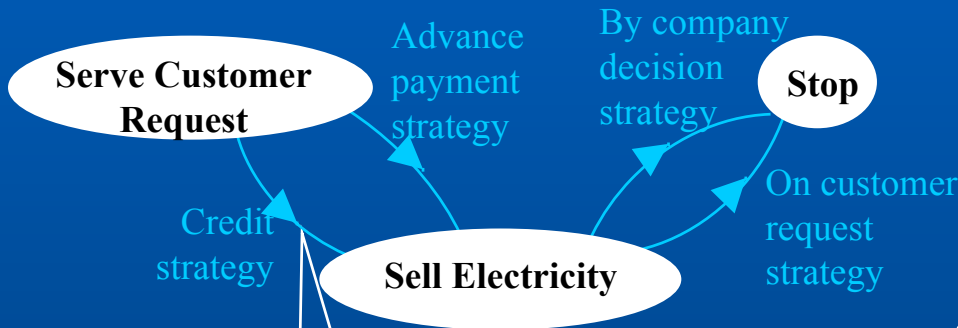
The ESM Map

ERP map to support Electricity Supply Management

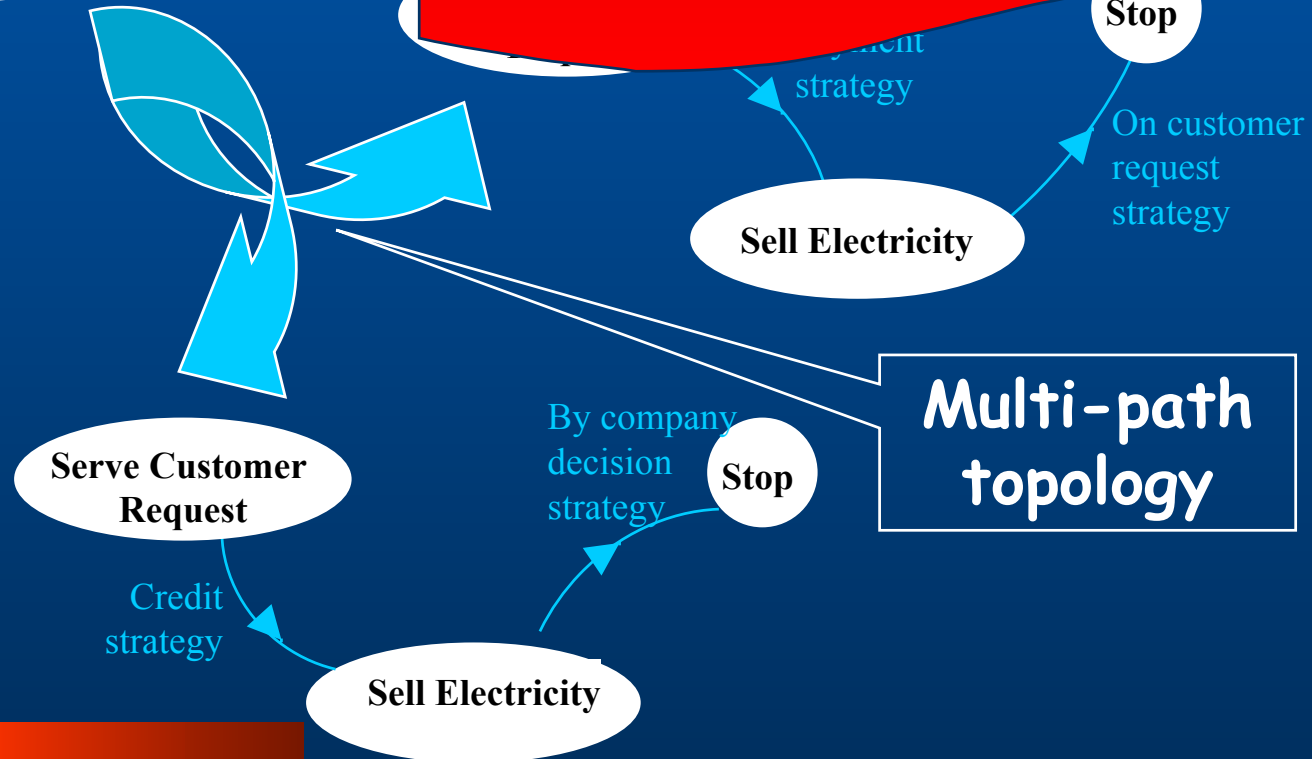


Modelling MFP with Maps

The multi-thread and multi-path topologies serve to capture multi-faceting : variability with multithread and composite faceting with multi-path



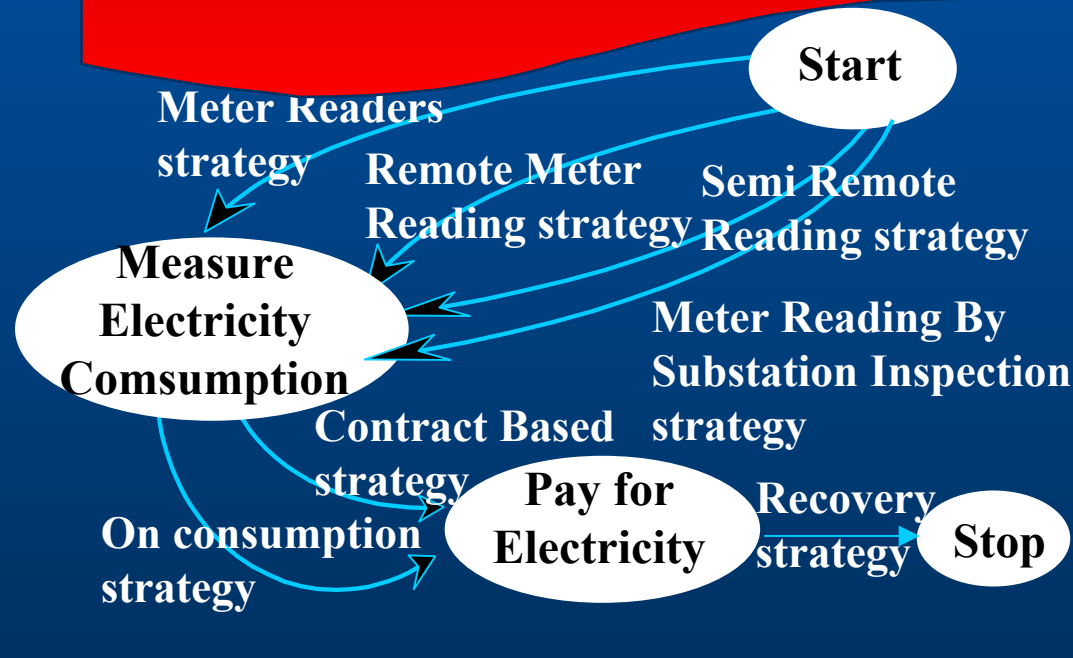
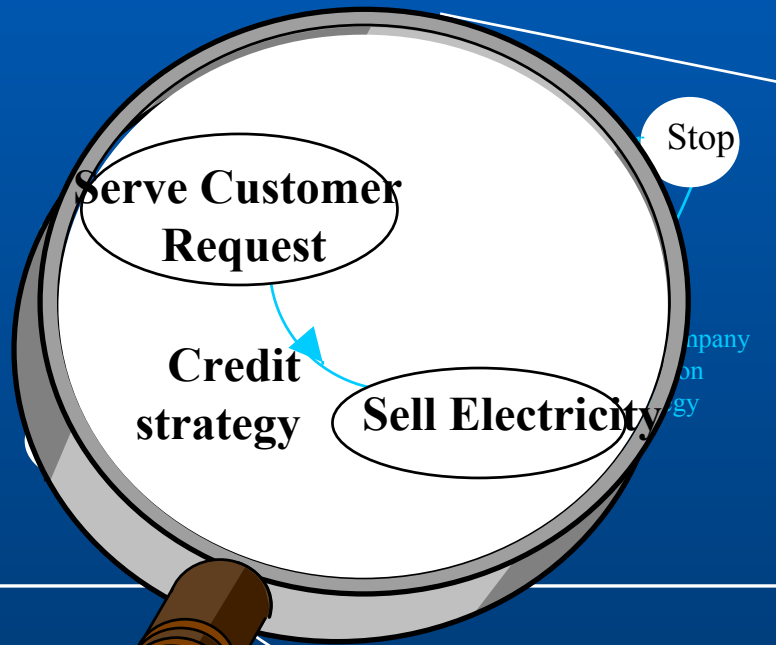
Multi-thread topology



Multi-path topology

Refining facets through map refinement

Refinement allow to look to the multi-faceted nature of a facet. It introduces levels in MFP representation which is fully modelled as a hierarchy of maps



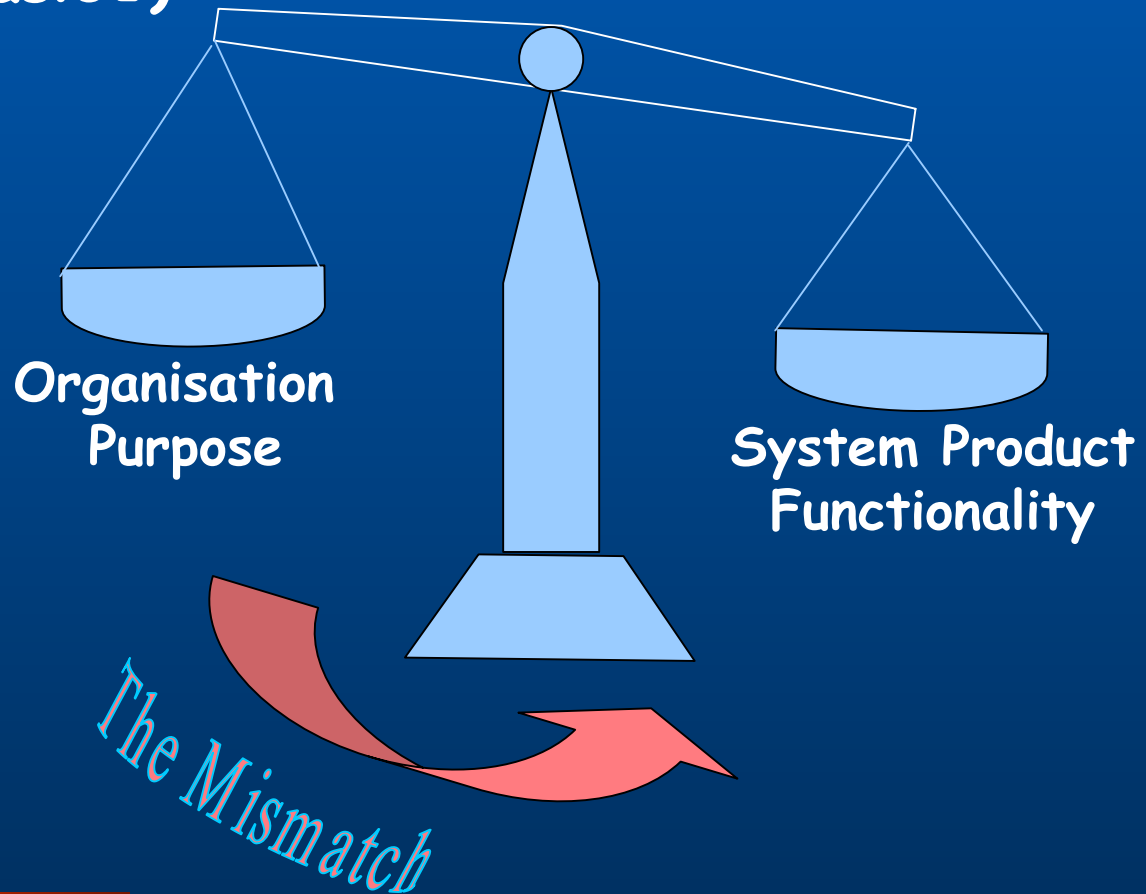
Modelling the MFP through a hierarchy of maps

- The purpose of the artefact is captured in a hierarchy of maps
 - At any given level of the hierarchy, the multi-faceted dimension is based on *multi-thread* and *multi-path* topologies

Multi-thread introduces local faceting
Multi-path introduces global faceting

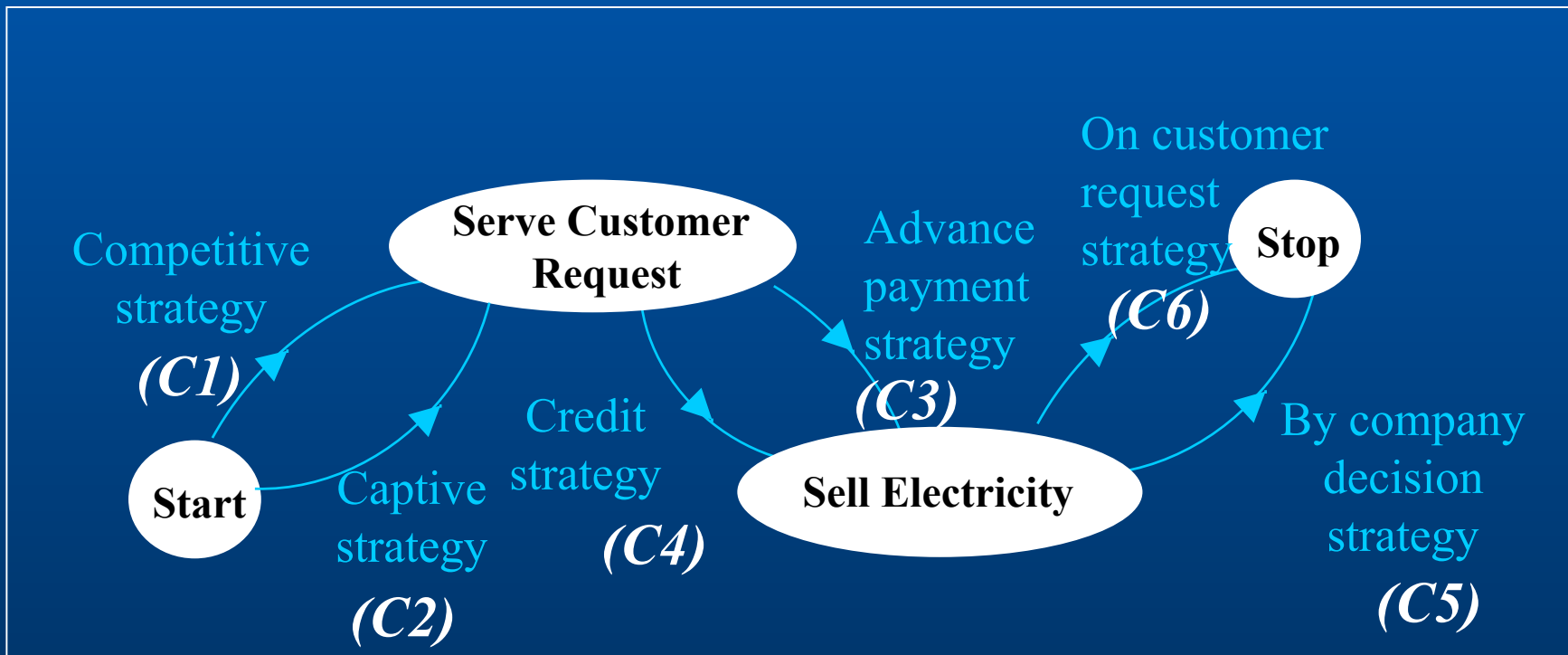
Aligning functionality & purpose

Avoiding the « conceptual mismatch » (Arsajanasi01)

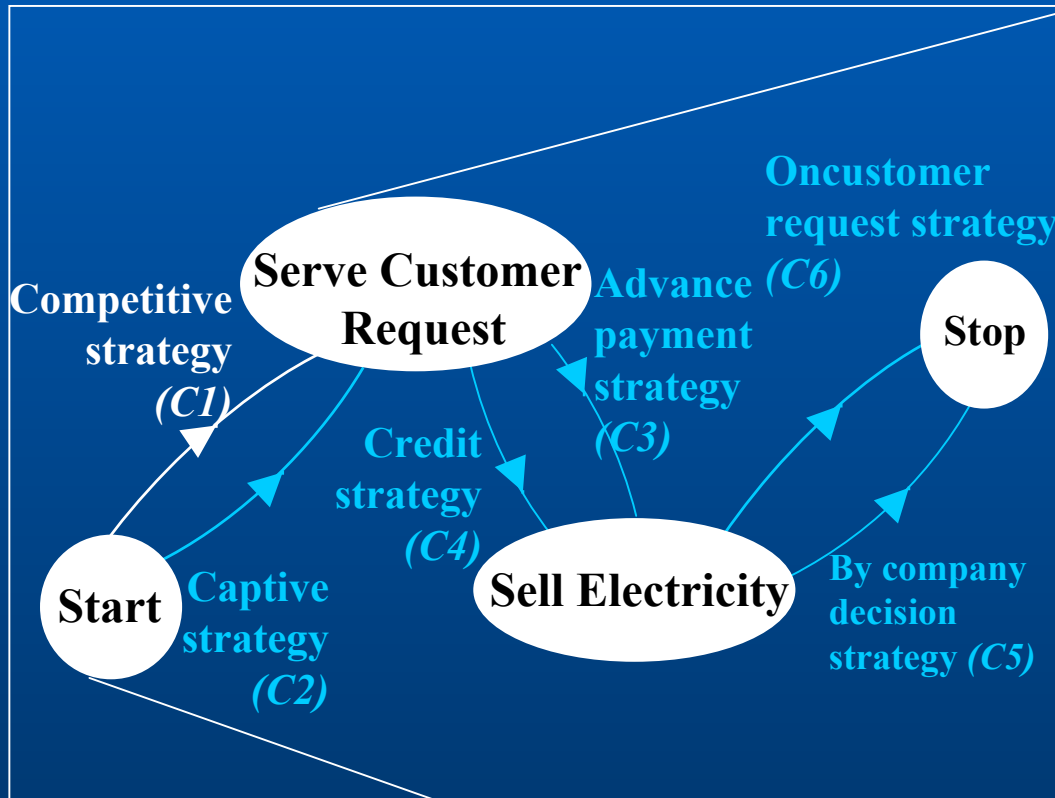


Aligning functionality & purpose

Relating each section in a map to a functionality component



Aligning functionality & purpose



Reference

C1

Component Name

Customer servicing in a competitive environment

Component Interface

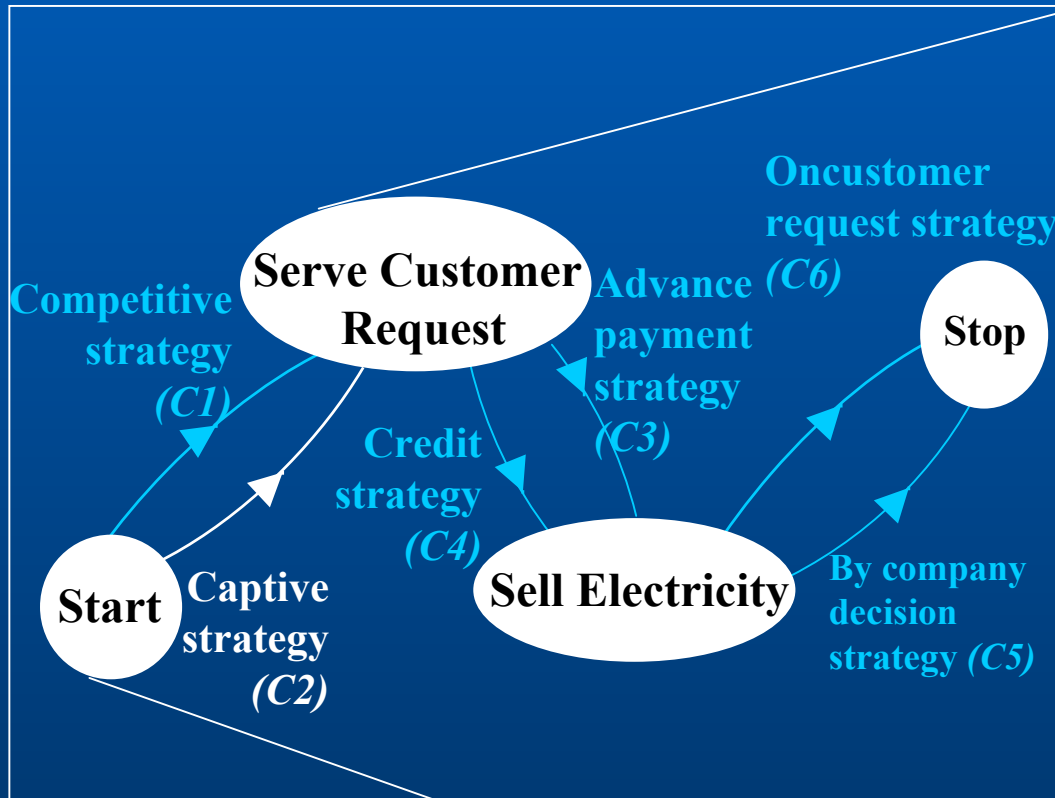
<(As-Is model, Serve Customer Request with Competitive strategy)>

Component Body

Provides IT support to

- install an IFD to serve customer request
- develop customer culture within the company and measure customer satisfaction
- contract customers
- market the company

Aligning functionality & purpose



Reference

C2

Component Name

Customer servicing in a captive environment

Component Interface

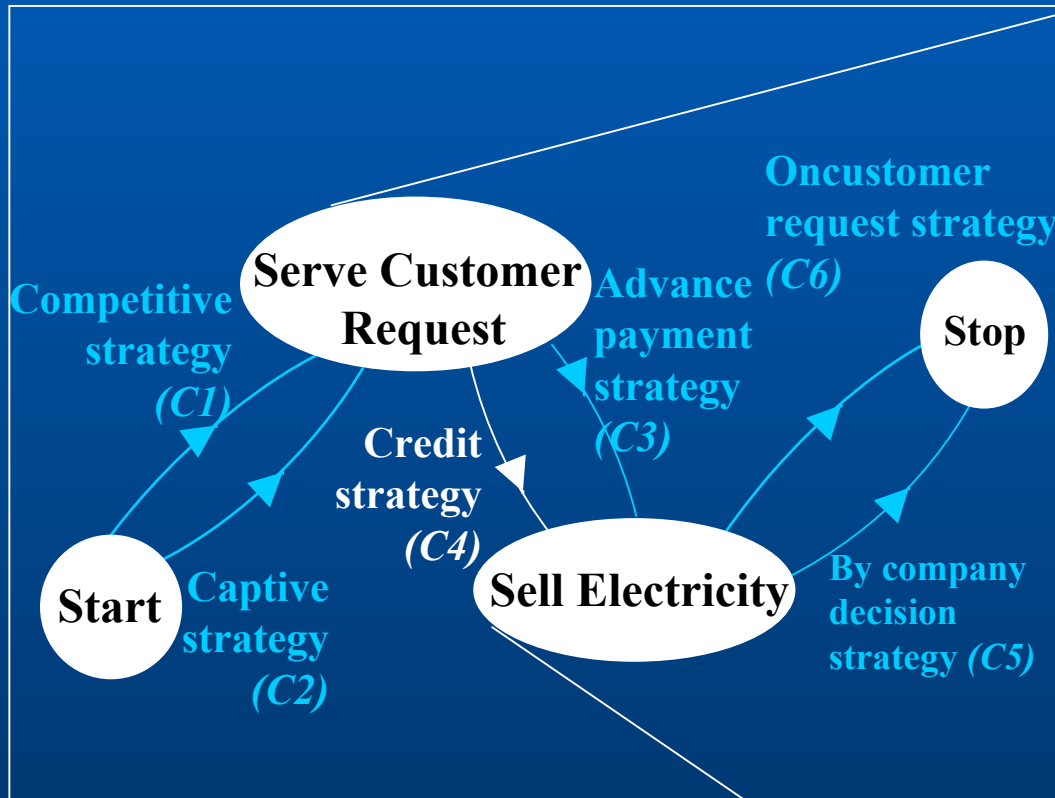
<(As-Is model, Serve Customer Request with Captive strategy)>

Component Body

Provides IT support to

- handle customer requests
- keep track of customer complaints
- keep track of customers and customer installations information

Aligning functionality & purpose



Reference

C4

Component Name

Electricity selling in a conventional way

Component Interface

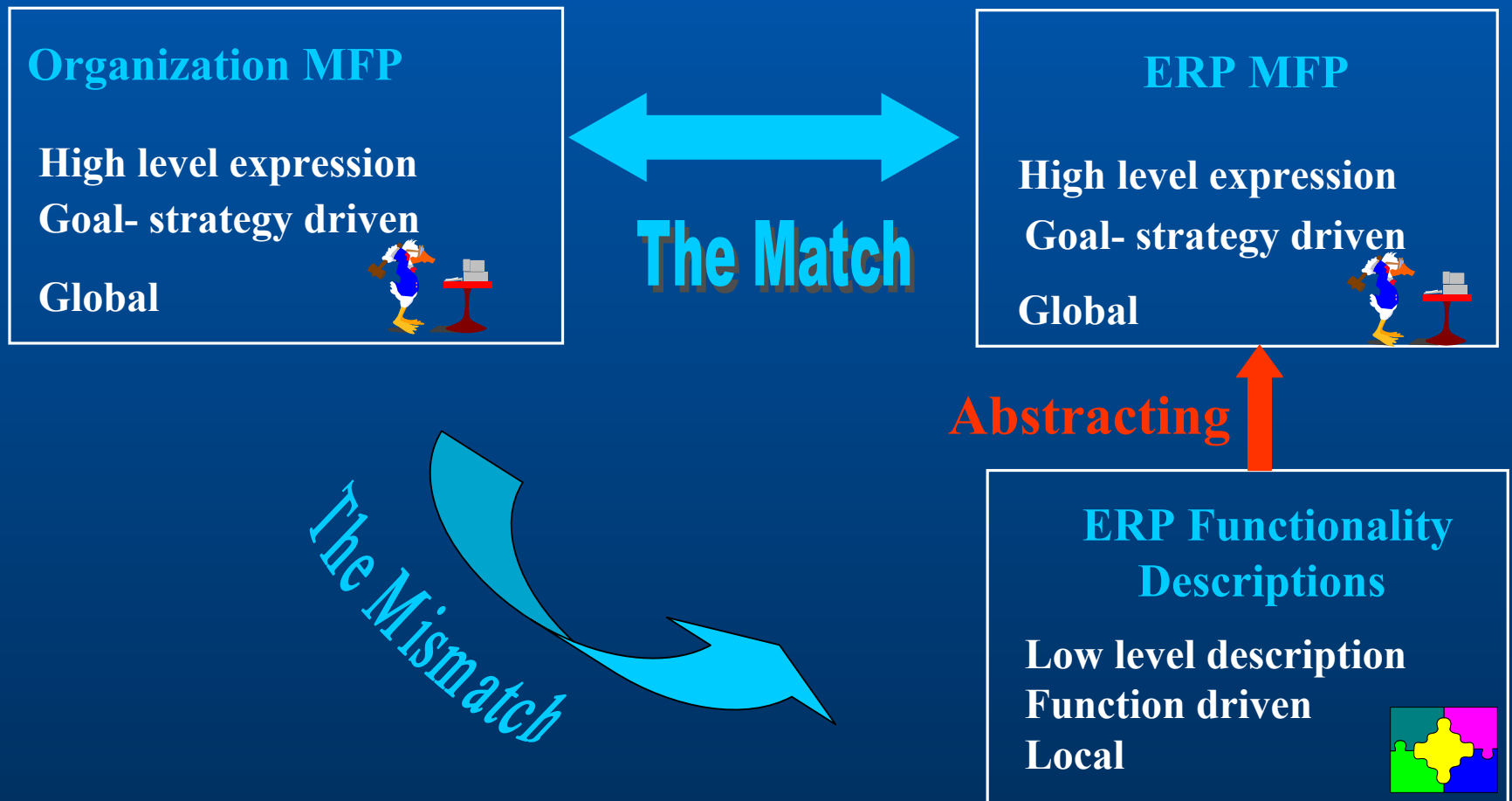
<(Customer meter Id), Sell Electricity with Credit strategy>

Component Body

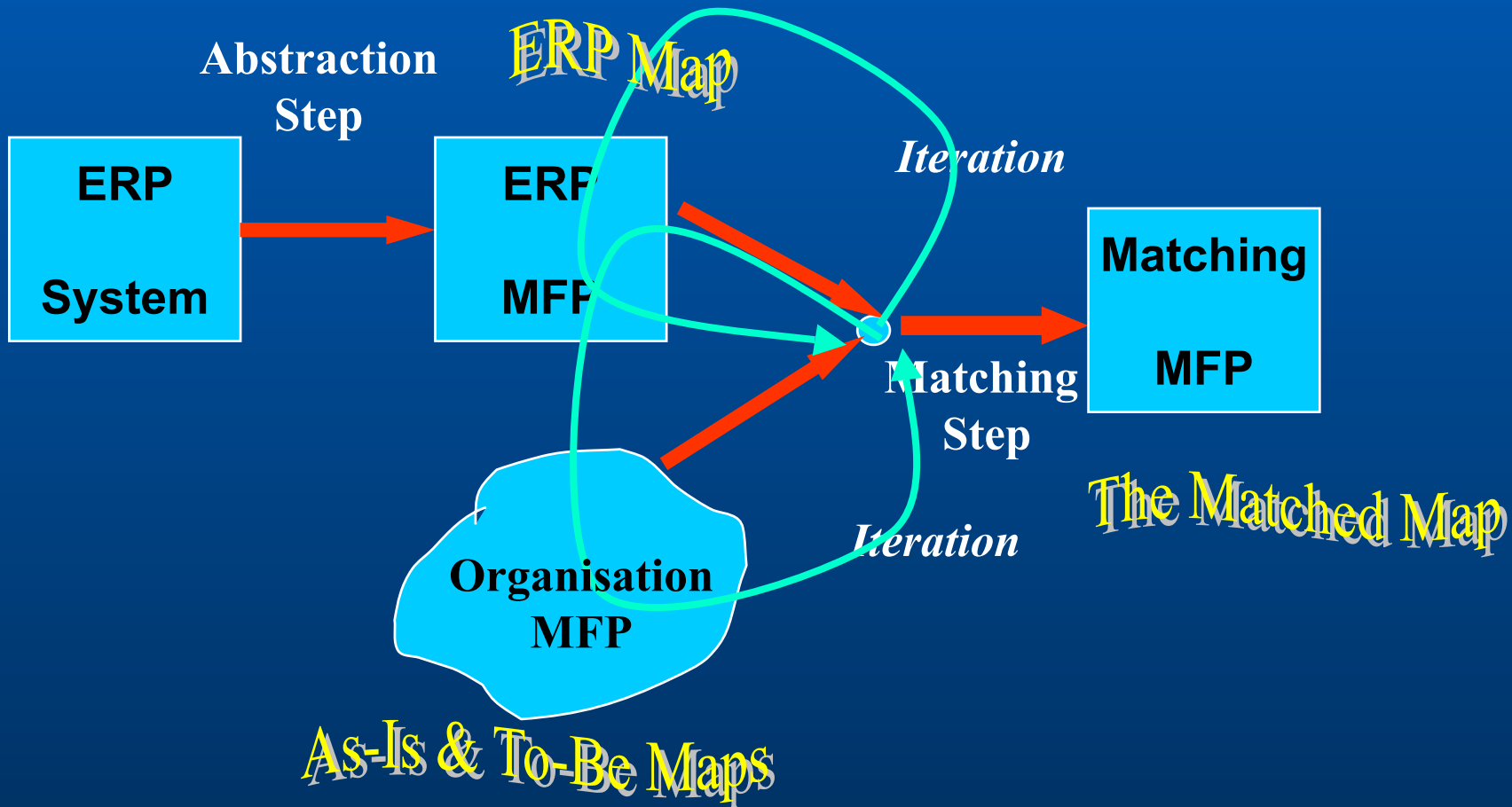
Provides IT support to manage the process chain of conventional meter reading, electricity consumption billing and payment collection

Complex component deployed as a map of components

Customizing MFP



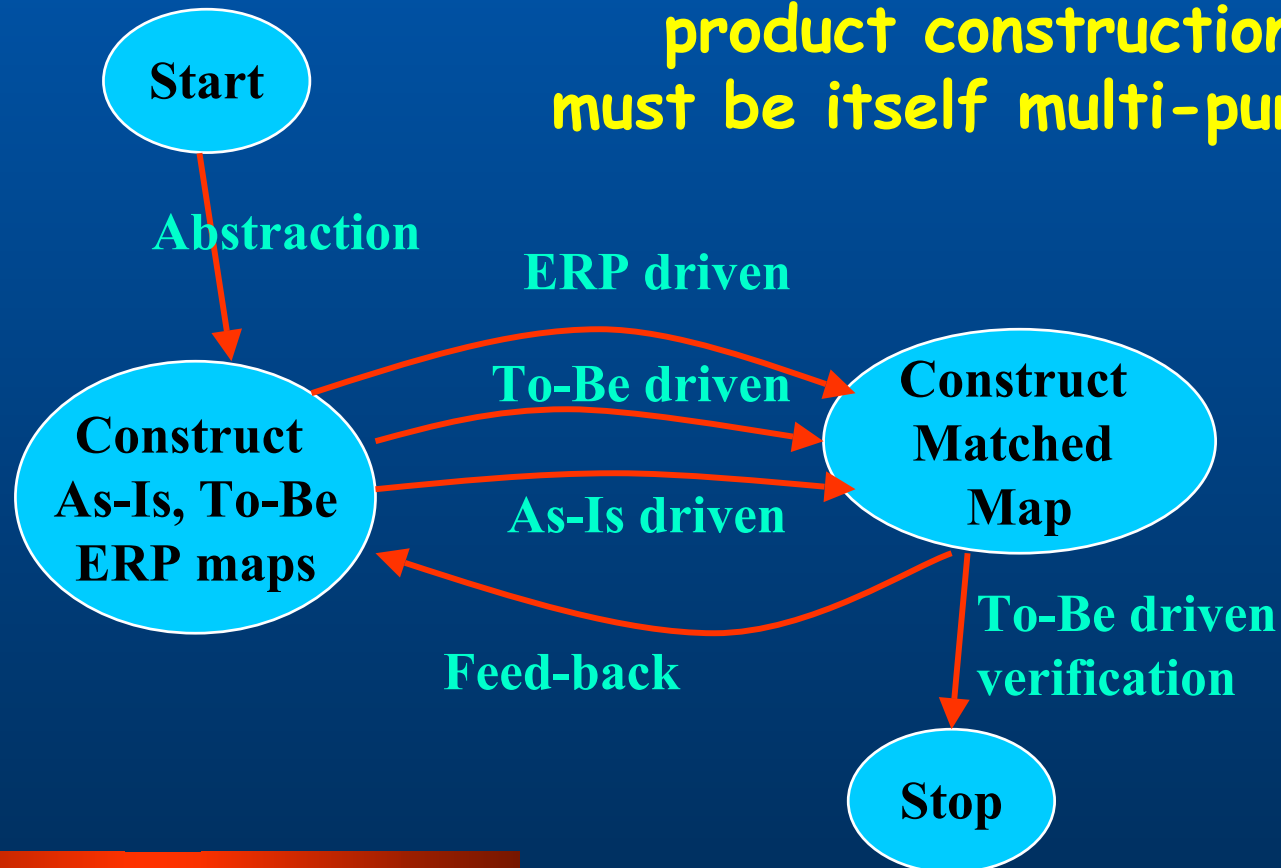
Customizing MFP



Customizing MFP

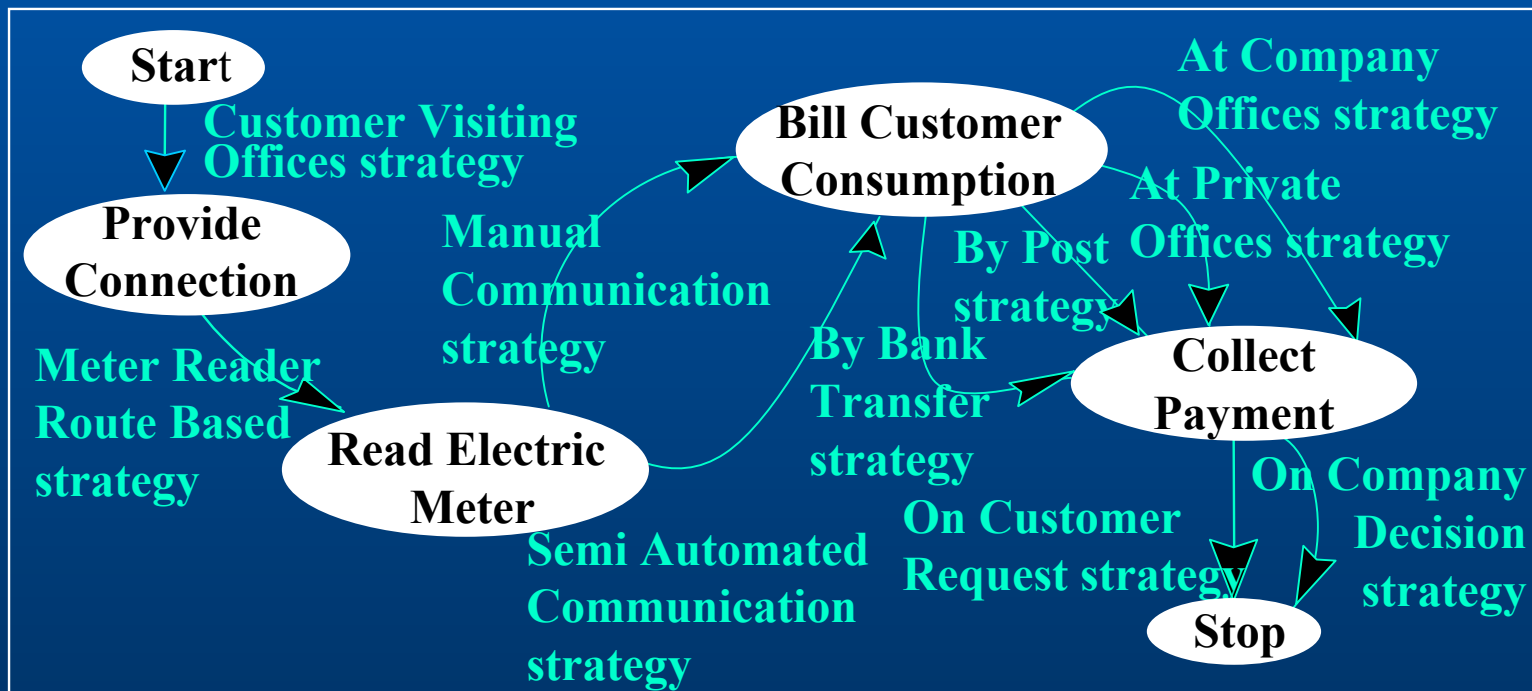
The Matching Process Model

The process for multi-purpose product construction must be itself multi-purpose



Customizing MFP

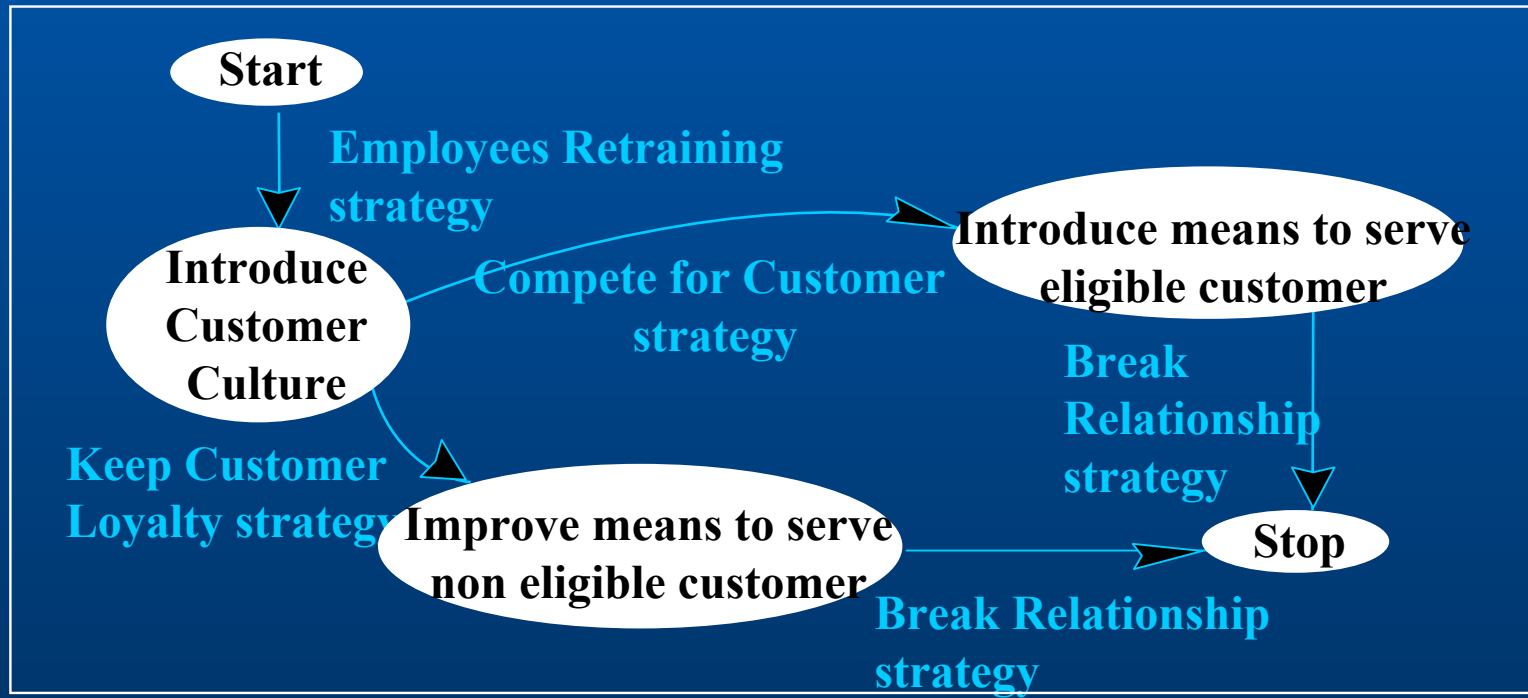
Illustrating the Matching Process



As-Is Map of the ESM Case Study

Customizing MFP

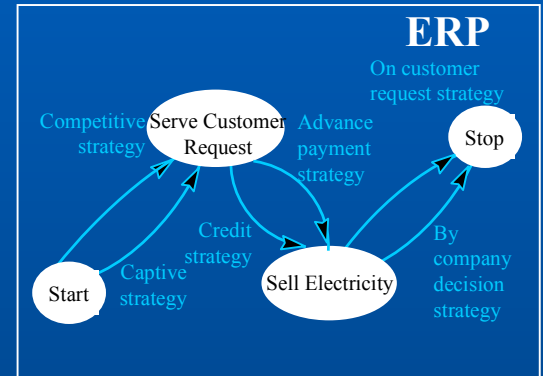
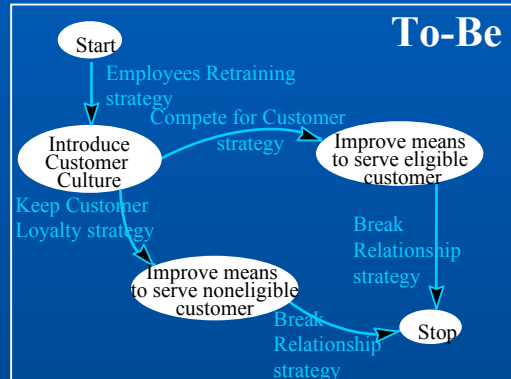
Illustrating The Matching Process



The ESM To-Be Map

Customizing MFP

Building the Matched Map

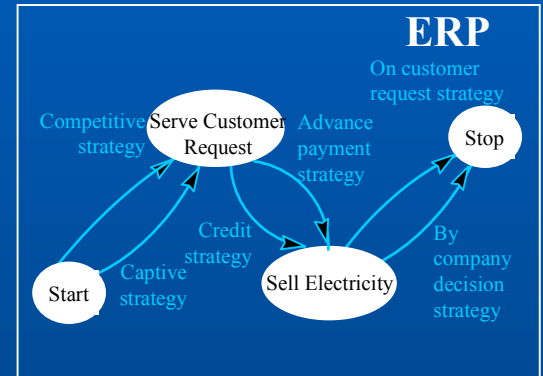
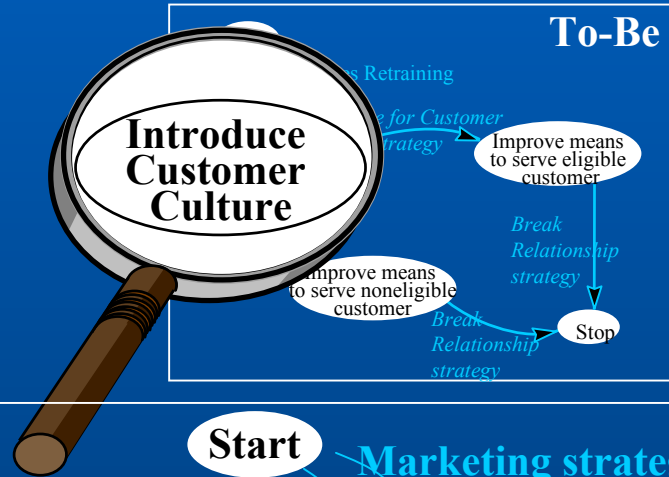


Competitive strategy



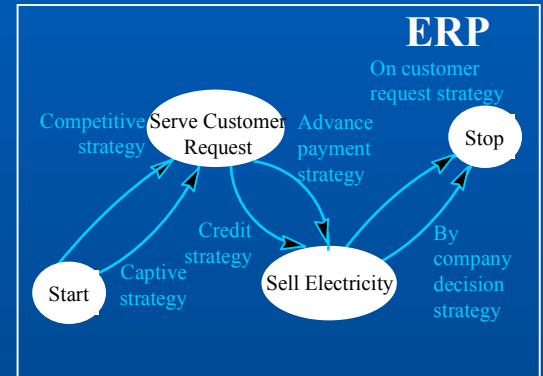
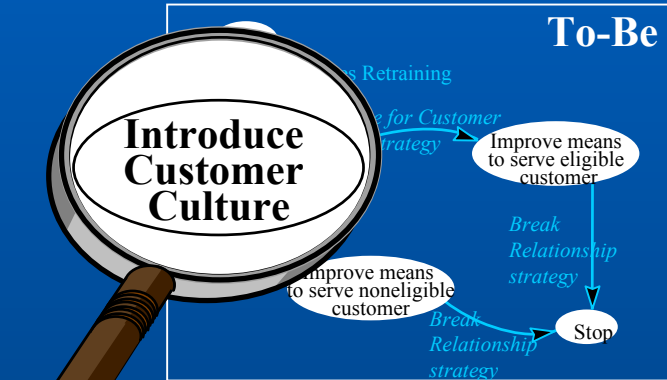
Customizing MFP

Building the Matched Map



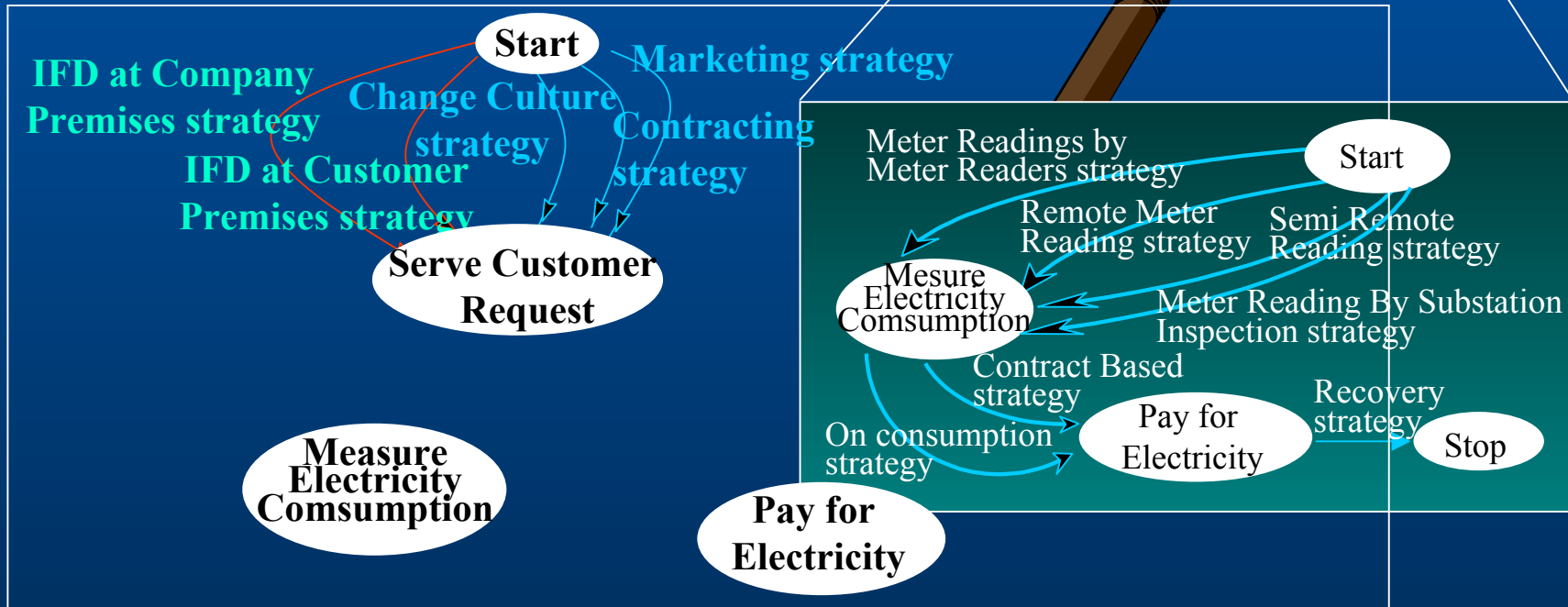
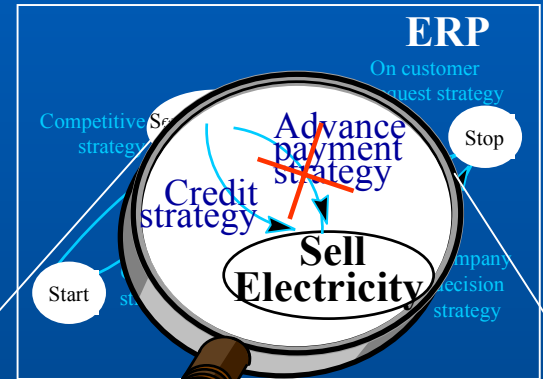
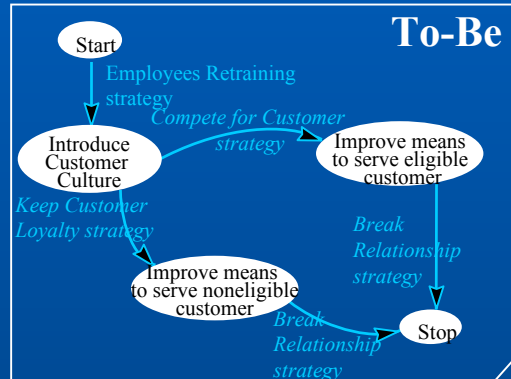
Customizing MFP

Building the Matched Map



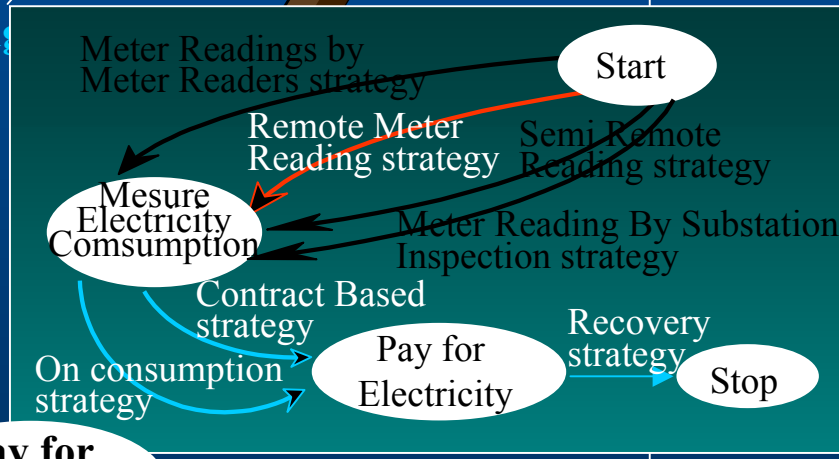
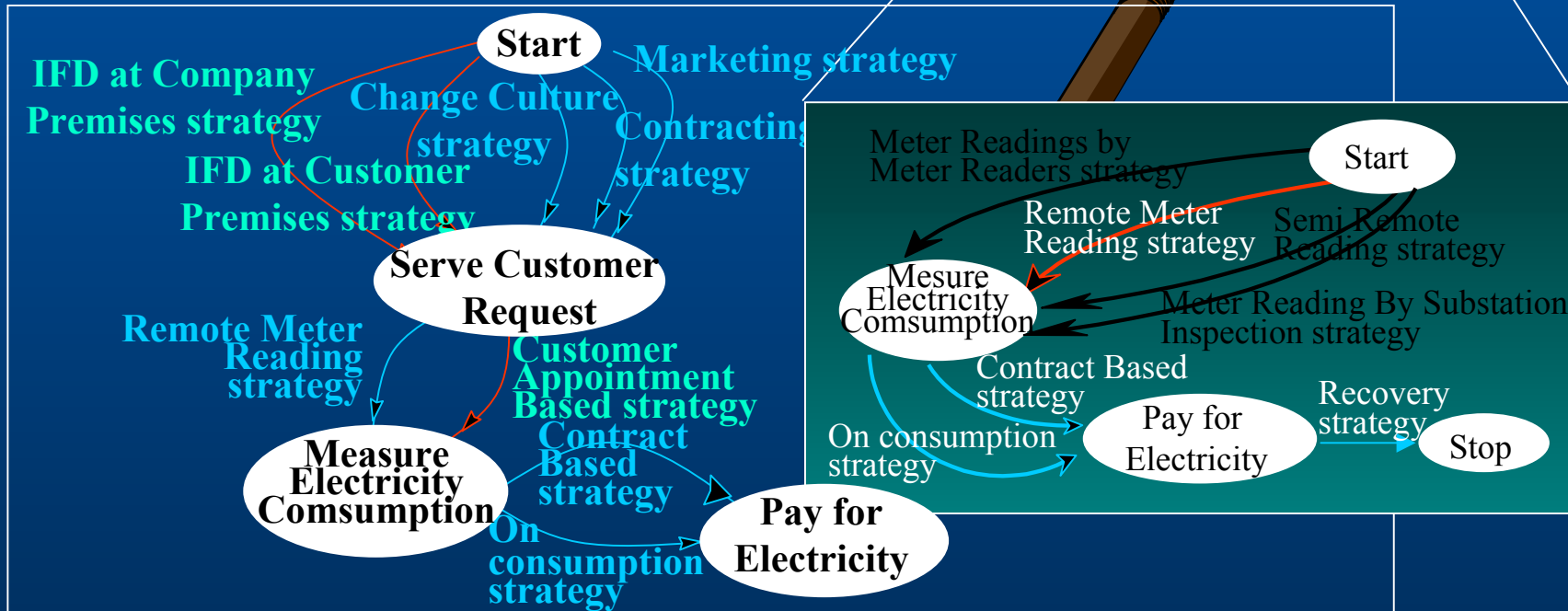
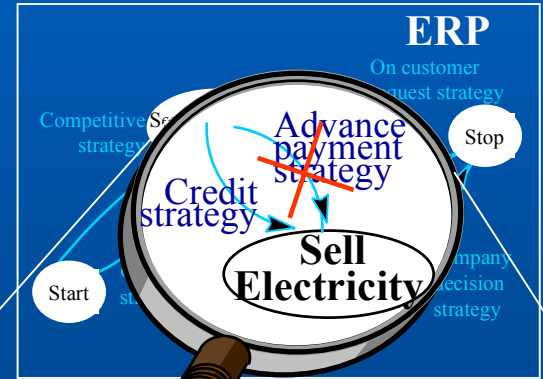
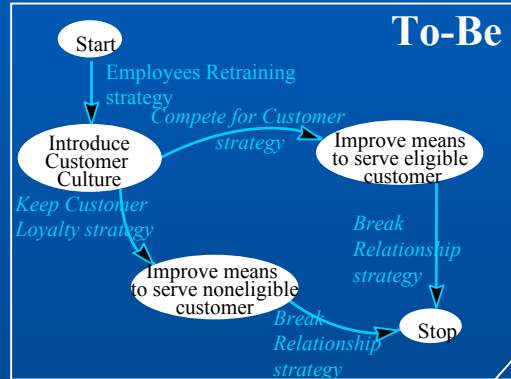
Customizing MFP

Building the Matched Map

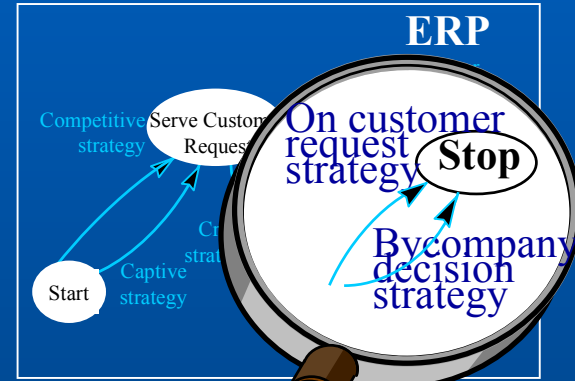
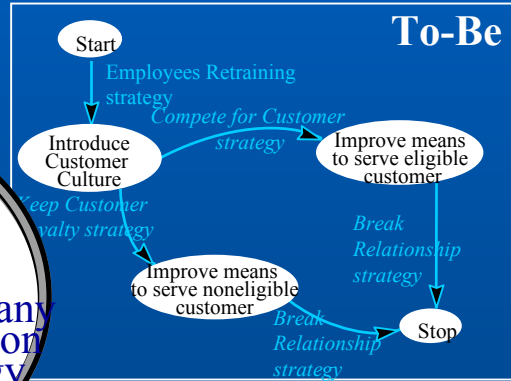
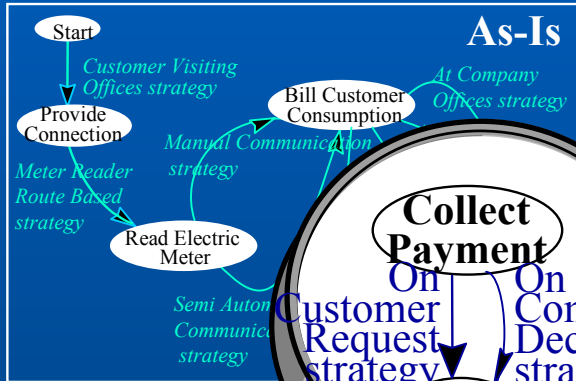


Customizing MFP

Building the Matched Map



Customizing MFP



Bye Bye François !

Thank You

