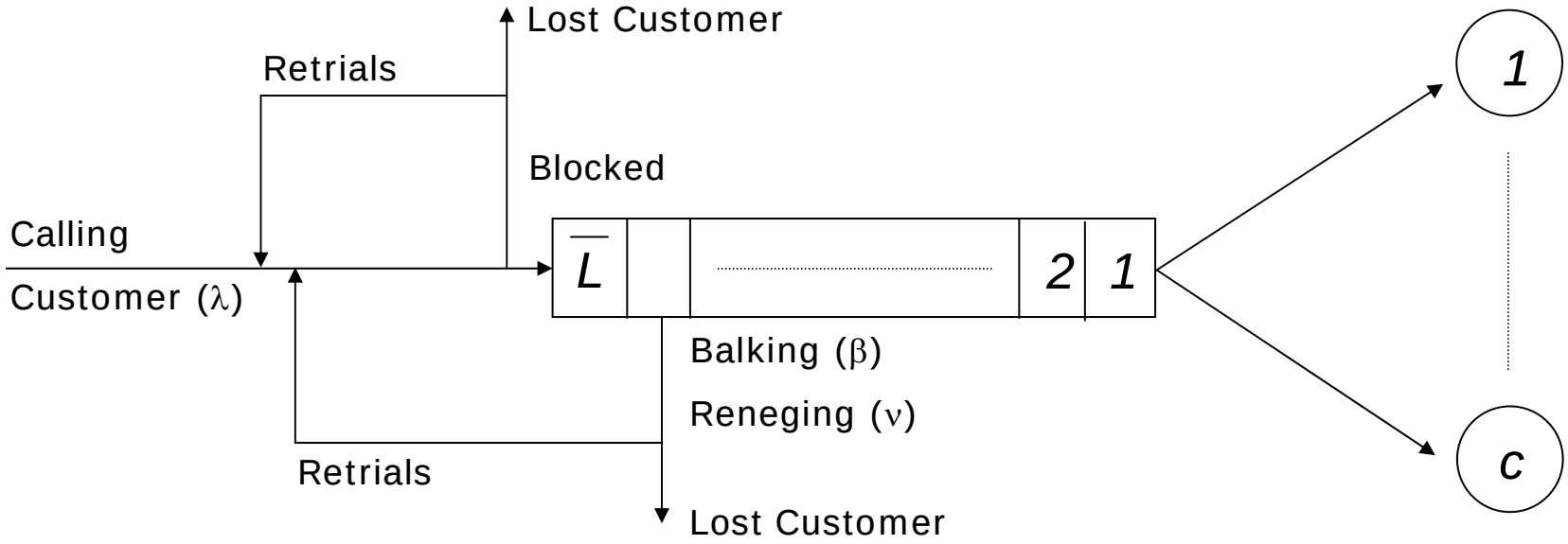
University of Rome “Tor Vergata” – Dpt. of Business Engineering and Mgmt.

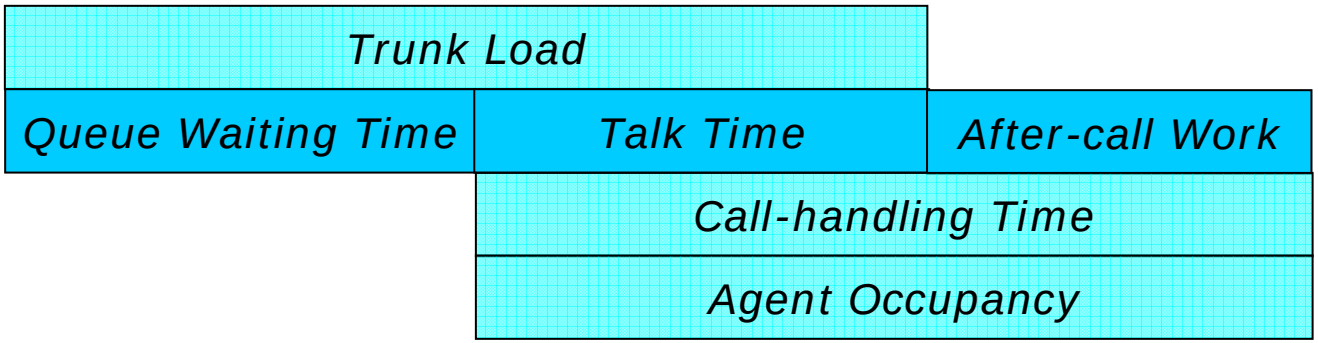
# Dynamic Skill Based Routing:
## a System Dynamics approach to a Policy Definition in Call Center Management

Stefano Armenia – *armenia@disp.uniroma2.it*
Alessandro Pietro Saullo – *alesaul@libero.it*
Habib Sedehi – *habib.sedehi@uniroma1.it*

# Call Center structure




Queue Time incorporates: Ringing + Delay Announcement + Music



# The problem

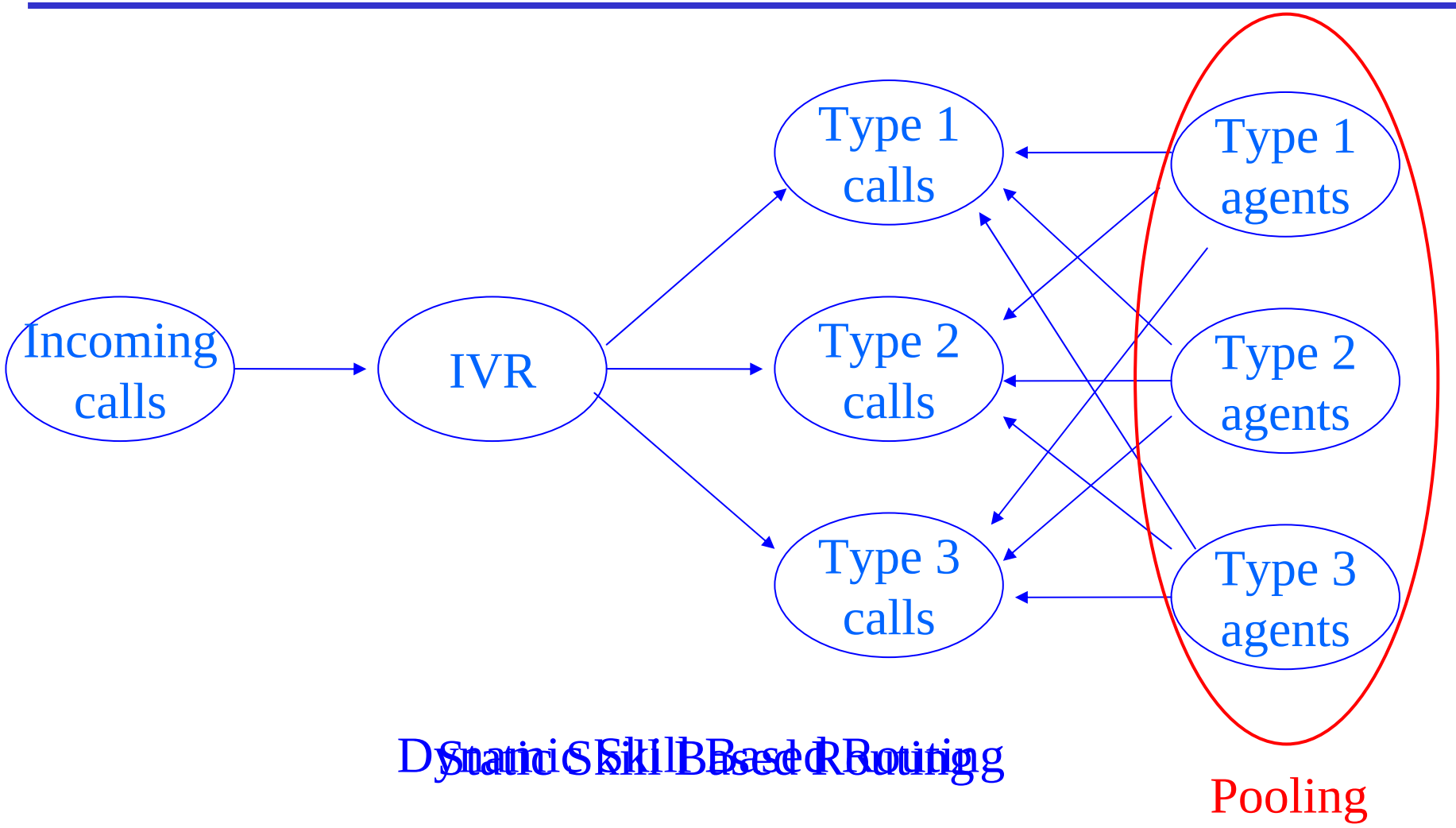
Some Call Centers need to process different types of calls at the same time.

This can be made in different ways, but the most common are the Static and Dynamic Skill Based Routing.

***Skill-Based Routing is a technique used to route calls to operators according to the requested skill for that peculiar call***

We will first have a look at what a static and dynamic SBR are and then build a model in order to explore which one of these two approaches behave better in a given situation.

# Static SBR and Dynamic SBR




Dynamic Skill Based Routing

Static Skill Based Routing

# Reasons to choose simulation

Erlang:

- overestimates staff and trunking needs
- Doesn't account for different groups of agents (effect of the "pooling principle"), Skill-Based Routing or network interflow
- Cannot analyse the transient behaviour of the system
- Distributions vary with time, also according to various relationships between dynamic parts of the system
- Does not account for burnout

Simulation:

- Uncertainty
- Complexity
- Dynamic Environment

# Applications of a simulation model

- Tactical
- Strategical
- Policy evaluation
- “What if” analysis
- Financial analysis

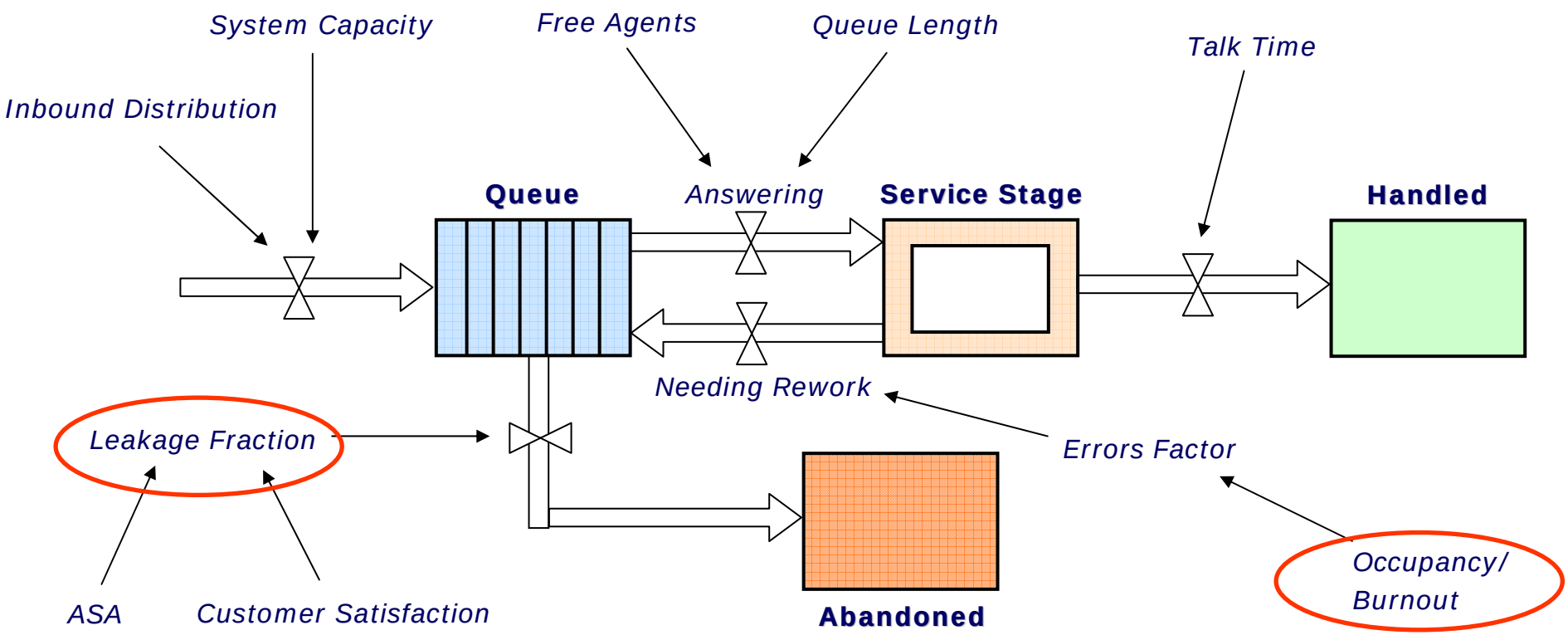
CALL CENTER MANAGEMENT

# Characteristics of a CC environment

- High dynamism
- Non-linear relationships
- Different types of data processed (both hard and soft)
- Multiple feedback processes
- Many interdependent components

DYNAMIC SIMULATION & SYSTEM DYNAMICS APPROACH

# Call Center calls flow

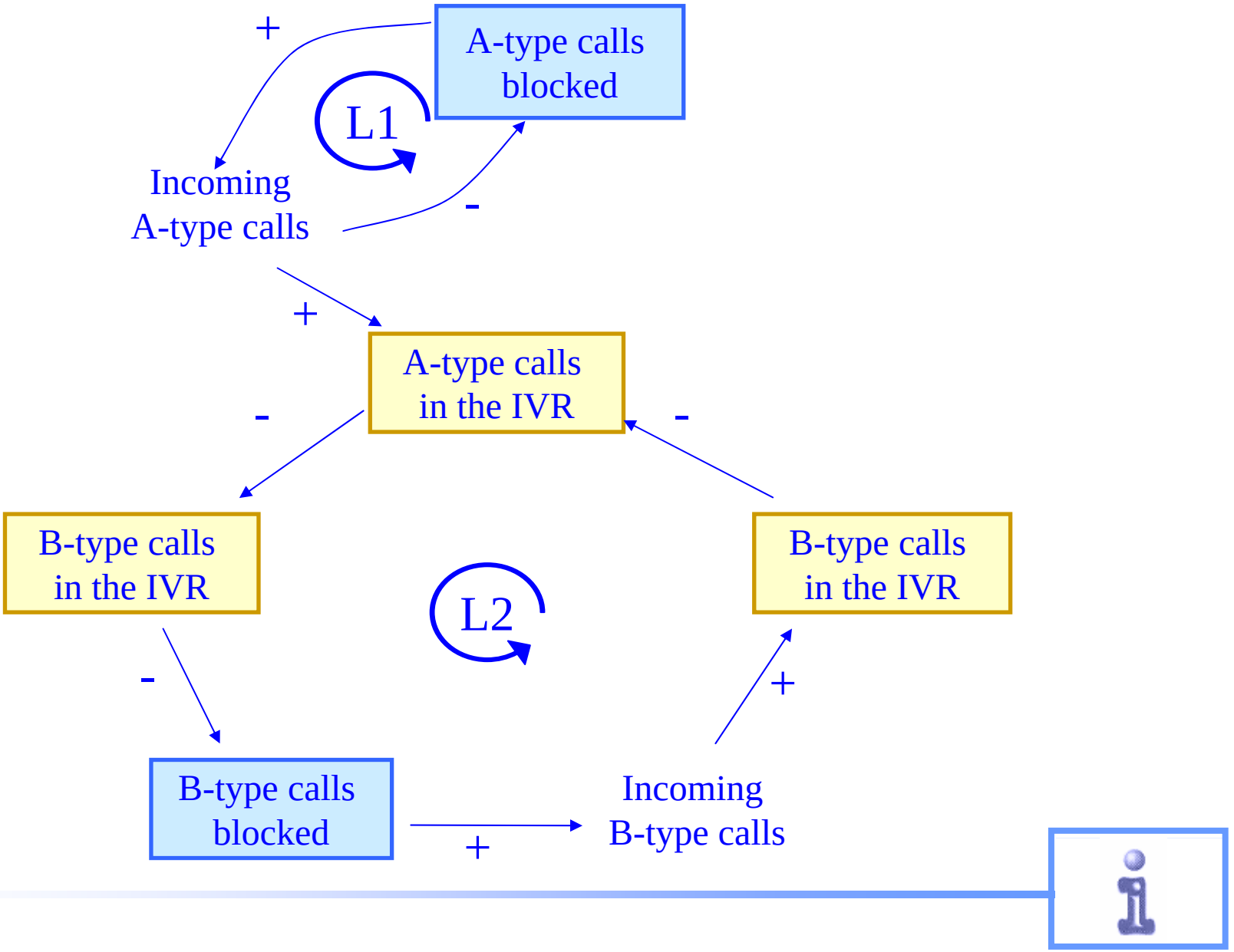



*Armenia, Caramia, Onori, Giannunzio (2003) – Proc. ISDC 2003 NYC*

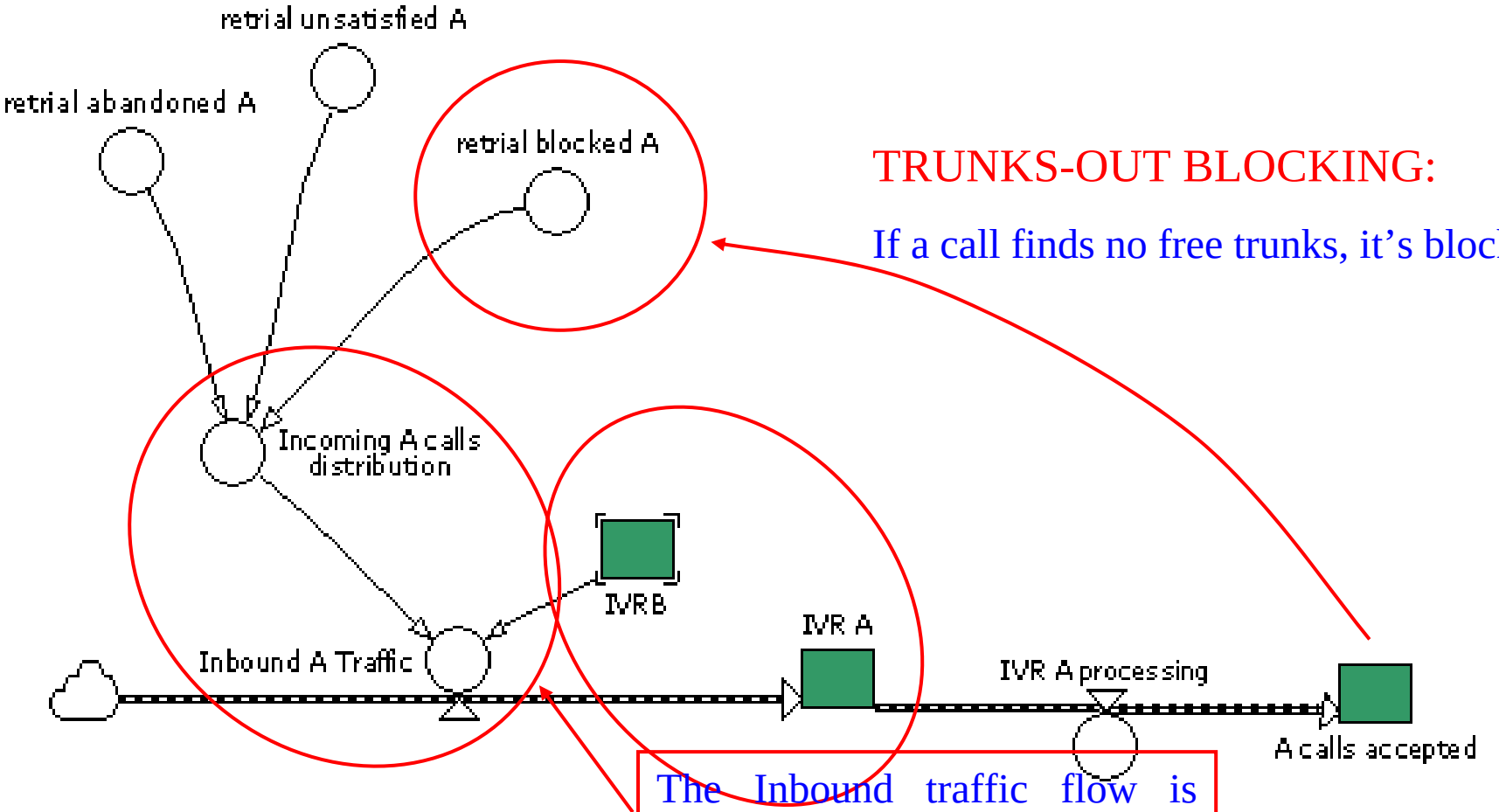
# Assumptions made

- 2 types of incoming calls (A-premium and B-standard)
- **SBR**:
  - *STATIC*: 2 groups of Specialized Agents (A-premium and B-standard)
  - *DYNAMIC*: 1 pool of Generalists (blended A and B skills)
- Call value based on Customer Satisfaction (Return on Quality)
- Callbacks generated by a % of both unanswered and unsatisfied calls
- Simulation run on a short period (tactical analysis)
  - No feedback on Customer Satisfaction on a long time-scale

# IVR causal relations



# Model example - A type calls arrivals

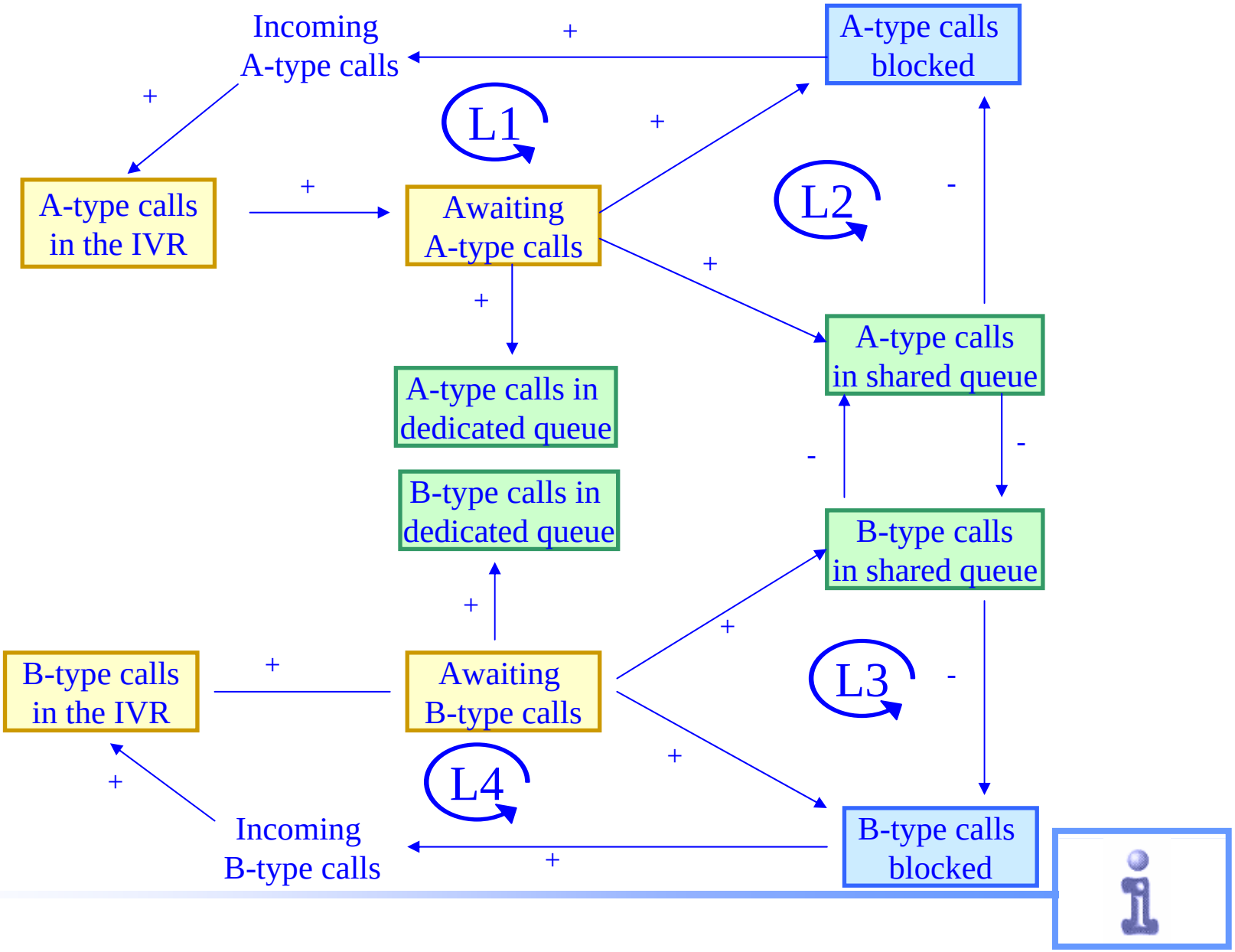



TRUNKS-OUT BLOCKING:

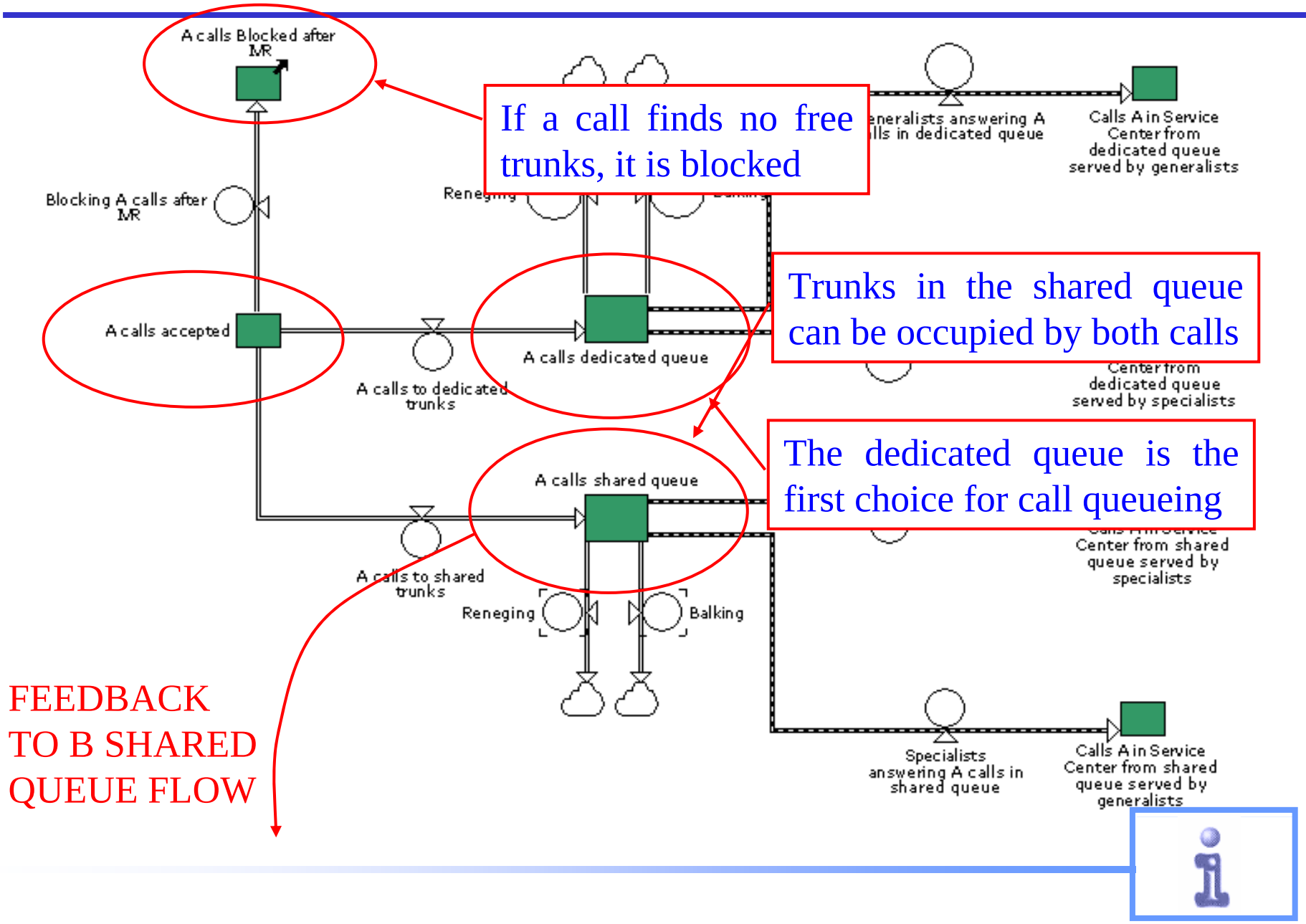
If a call finds no free trunks, it's blocked

The Inbound traffic flow is regulated by both A and B calls in the IVR

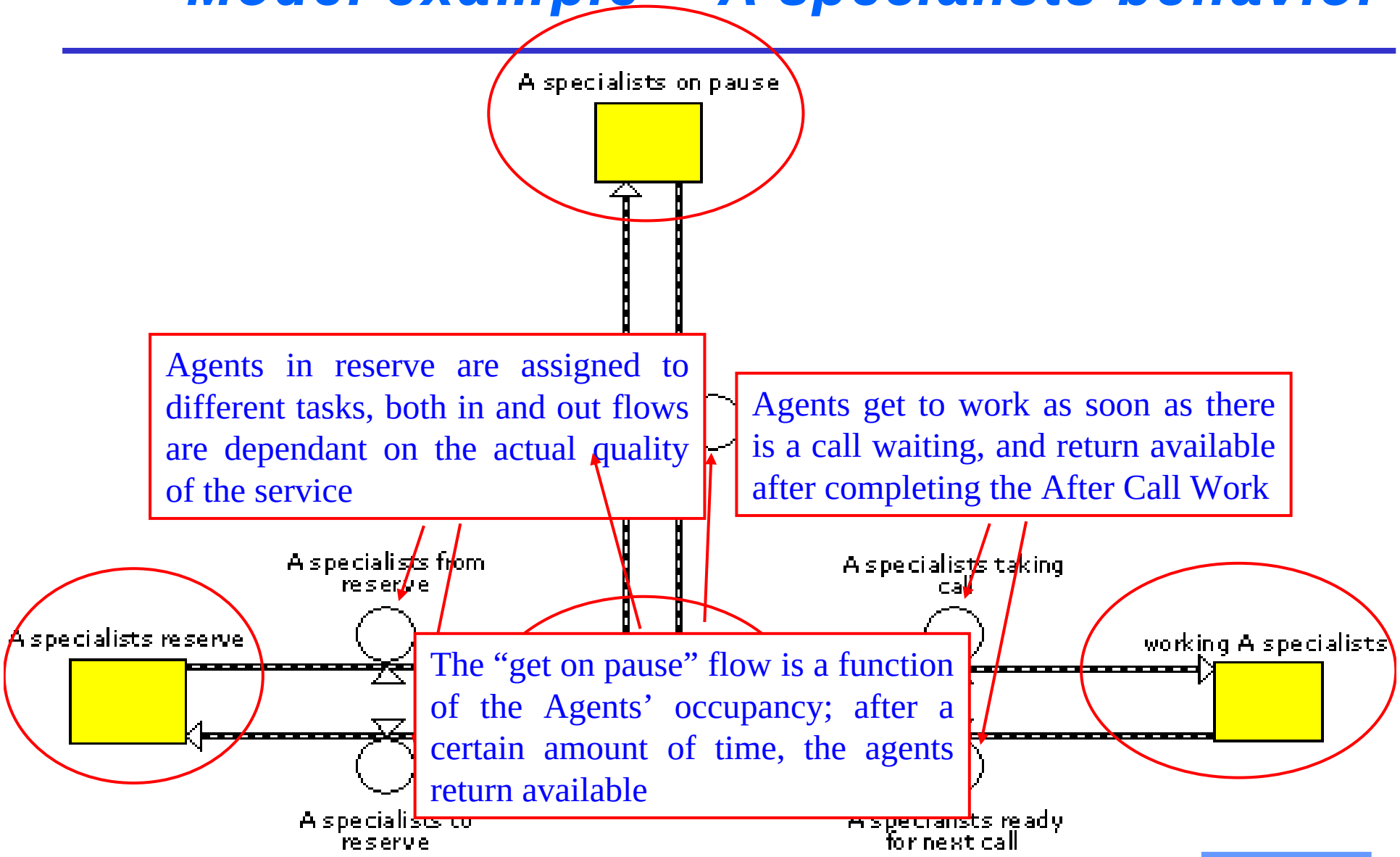
# Queue insertion causal relations



# Model example – A calls SBR behavior



# Model example – A specialists behavior



# An SBR Scenario Analysis

– Basic assumptions at start:

- 2 types of incoming calls (A-premium and B-standard)
- **SBR**:

*STATIC*: 2 groups of Specialized Agents (A-premium and B-standard)

*DYNAMIC*: 1 pool of Generalists (blended A and B skills)

– Premium and Standard calls share the same call-processing parameters (see next), and get however processed with a **priority policy** set according to their relative importance, the latter due to expected revenue from each call-type (€10 for a premium call, €6 for a standard call)

– The agents cost depends on their training and skill-set mix (skill levels adjusted so as to reflect an equal cost for specialized and generalists)

# Simulation parameters

Some other main assumptions and parameter settings:

| | |
|---|---|
| Simulation Duration Time (seconds) | 2700 (45mins) |
| Number of Operators | 120 |
| Number of Calls/Type/half hour | 250 (375) |
| Average Talk Time (seconds) | 180 |
| Average time (seconds) due to After Call Work | 30 |
| Service Level objective | 80% answered in 20 seconds |

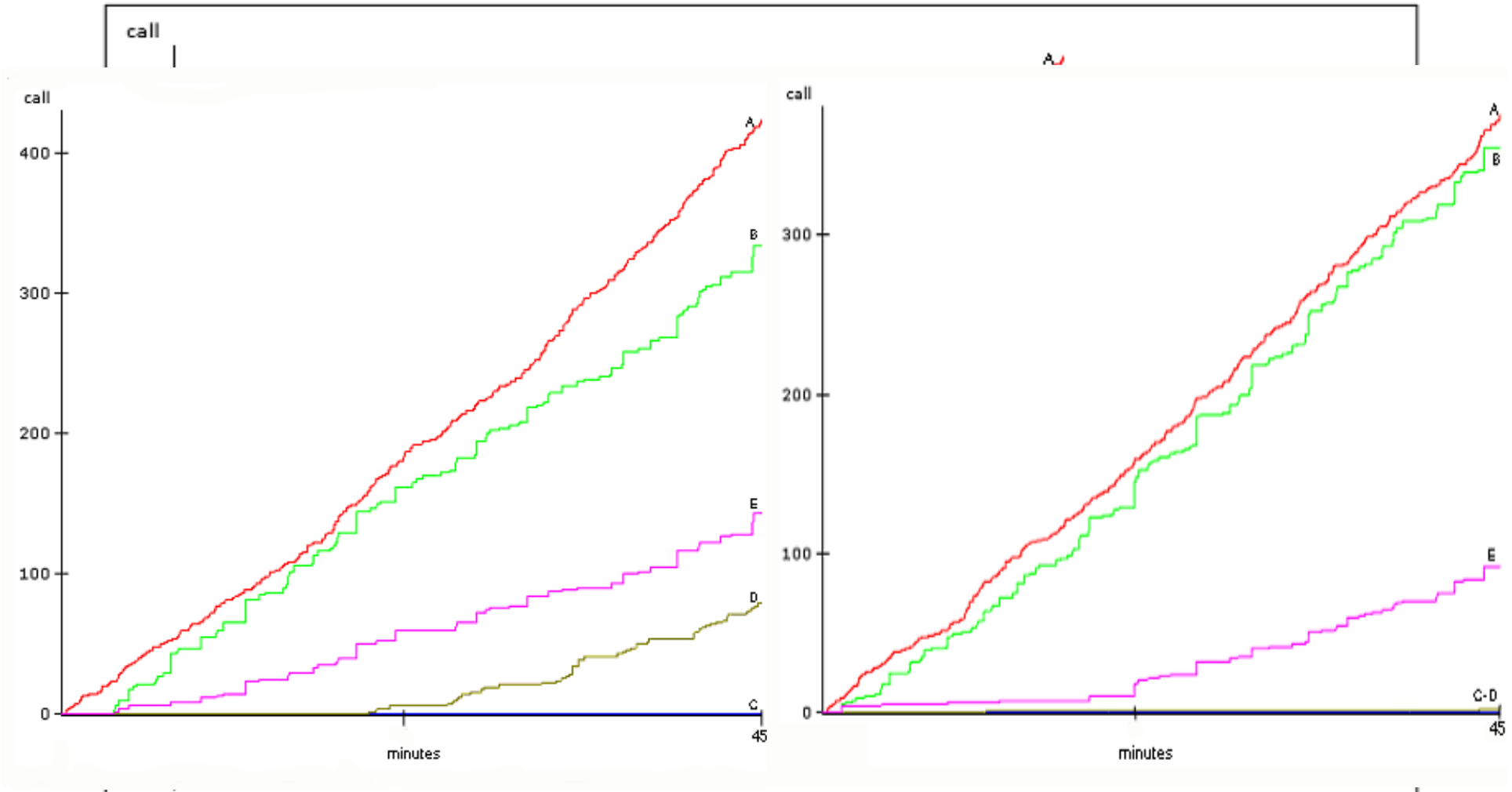
# Simulation results

| | A type calls answered | B type calls answered | Service Level | Profit (€) | Quality factor |
|---|---|---|---|---|---|
| Static SBR | 356 | 371 | 0,76 | 2554 | 0,83 |
| Dynamic SBR | 372 | 349 | 0,85 | 3497 | 0,89 |

**Profits** = Revenues due to call_value – overall costs

**Quality Factor** = SL (N:0,20) + Avg_Skill_Lvl (N:0,20) + Abnd_Pct (N:0,20) + RwkPct (N:0,20) + Profit_Factor (N:0,20)

# A calls behavior in time



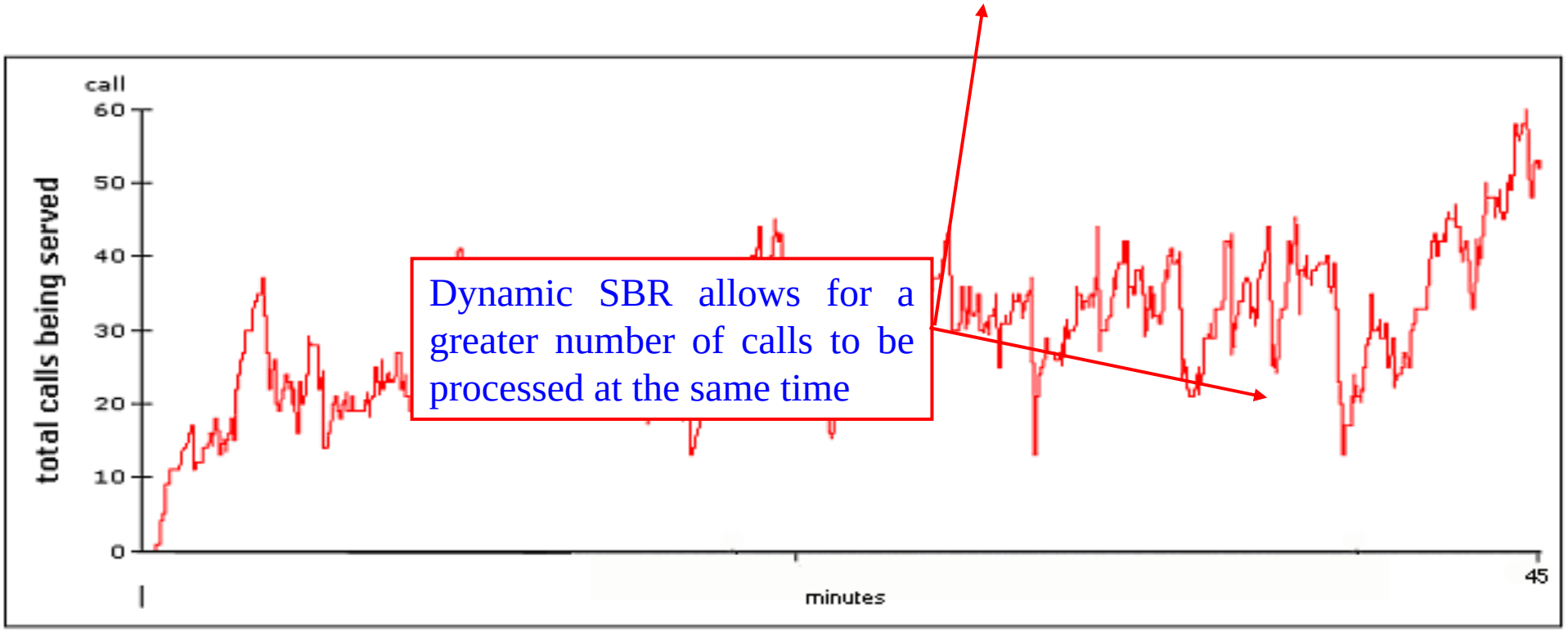

Static

Dynamic Skill Based Routing

Dynamic

Dynamic Skill Based Routing

# Calls answering procession




Dynamic Skill Based Routing

Dynamic Skill Based Routing

# Conclusions and future work

- Call Center management can make a good use of simulation instruments
- Dynamic SBR can dramatically improve a CC performance
- Future work could focus on considering a strategic (middle-long term) level of simulation (thus including the development of soft factors like Agents Experience, Customer Satisfaction, etc…) and on making the model able to comunicate with Informative Systems (ERP) or in general with data-sets