ICT Support for Regional logistics platforms

W. Ukovich

Dip. di Elettrotecnica, Elettronica e Informatica
University of Trieste

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Hotel Schweizerhof Luzern
Schweizerhofquai 6002 Lucerne
Switzerland

Outline

- A PRIN Italian project
- Integrated ICT logistics system
- Other projects
- Feasibility study for an integrated ICT logistics system
- SILI: an integrated ICT-based logistics system
- Case study: the Port of Trieste

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A PRIN Italian project

(a **National Interest** Research Project

of the Ministry of Education, University and Research)

Decision models for design and management of **logistic networks** characterized by high interoperability and **information** integration

Scientific coordinator: Prof. Riccardo Minciardi, University of Genoa

Project period: 24 months

A PRIN Italian project

5 research units:

- Prof. Riccardo Minciardi, University of Genoa
- Prof. Maria Pia Fanti, Polytechnic of Bari
- Prof. Paolo Valigi, University of Perugia
- Prof. Alessandro Agnetis, University of Siena
- Prof. Walter Ukovich, University of Trieste

A PRIN Italian project

Main objectives:

- to develop suitable approaches and **methodologies** for the definition of the **decision/information architecture** for real-time management of logistic systems, at a regional or inter-regional level
- to analyze how the definition of the information architecture affects the **decisional architecture** of the system
- to identify global **performance** indexes of the logistic system and to analyze how they are influenced by the definition of the information architecture and by the decisional architecture

A PRIN Italian project

5 phases:

1. Definition of one or more **models** of the logistic network, concerning the decision and information architecture
2. Development of models for the management of **continuous** logistic flows

A PRIN Italian project

3. Development of decisional models for logistic systems characterized by **discrete**-event dynamics
4. Analysis of **specific problems** and development of models for critical application sectors
5. Analysis of the **impact** of the **information** structure definition on the overall system **performances**

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Integrated ICT logistics system

SILI

- Sistema Informativo Logistico Integrato,

  (Integrated ICT Logistics System),

  Friuli Venezia Giulia Region, Italy

Objectives

- To increase the efficiency of the regional logistics
- To support intermodal freight transport

Integrated ICT logistics system

How

- Supporting the **synchronization** of the logistics operations
- Promoting **information exchange**

Approach

- **Connecting** the regional stakeholders, in particular the infrastructures (horizontal integration)

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Analysis of the literature

Several European projects:

- ARKTRANS: Norwegian system for multimodal transport supporting freight and passenger transport, 2001-2006, vertical integration among stakeholders
- FREIGHTWISE: framework for intermodal transport, 2006-2010, ARKTRANS is the starting point
- EURIDICE: research on intelligent cargo, 2008-2010, electronic passport for goods

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Feasibility study

Analysis in four phases:

1. high-level analysis: review of the **stakeholders**, their objectives and functionalities of SILI
2. arrangement of a **questionnaire**
3. analysis of the results of the **interviews**
4. definition of the minimal **requirements** of SILI

High-level analysis

1. Stakeholders:
    1. Transport operators
    2. Infrastructure managers
    3. Authorities
    4. Information providers
    5. Trade associations

High-level analysis

2. Objectives:
    1. Cost reduction
    2. Effectiveness and quality
    3. Providing access to the logistics systems
    4. Environmental sustainability
    5. Safety and security

High-level analysis

3. Functionalities:

   Spread information

Questionnaire

“Maieutical” approach to guide stakeholders:

- What are your **objectives**?
- Which **strategies** would do like to implement to achieve your objectives?
- What is the **information** needed to implement your strategies?

Analysis of the results of the interviews: 20 stakeholders

- Main objectives: infrastructure managers choose **information accessibility**, transport operators choose **service effectiveness** and quality and cost reduction

- The strategies:
- **Interaction** and information exchange
- **Knowledge** about the state of the infrastructures as regards congestion levels and unexpected events
- **Localization** and traceability of goods

Analysis of the results of the interviews: 20 stakeholders

- The stakeholders feel to need to better **interact** among them, both in exchanging information and in taking decisions
- the quantity and the quality of the information available is rather **poor**, scattered and informal
- there is few or no information-systems **integration**
- data entry is often **repeated**
- few information is available on the general **state** of the logistics system

Definition of the minimal requirements of SILI: four functions

1. providing information about the **state** of the **infrastructures** such as congestion, time of admission and unpredictable events
2. providing information about management of **hazardous materials**
3. providing information about management of **papers** via telecommunication devices (especially with customs)
4. sharing data among transport operators about **tracking** and **tracing** of vehicles and goods

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SILI: an integrated ICT logistics system

- Start to initially implement the four functions and not a complex ICT system (**bottom-up** approach)
- Perform a **cost-benefit analysis** for the first function (provide information about the state of the infrastructures) :
  - **Costs** are easy to identify
  - **Benefits** are not clear, then a simulation approach is applied on a case study

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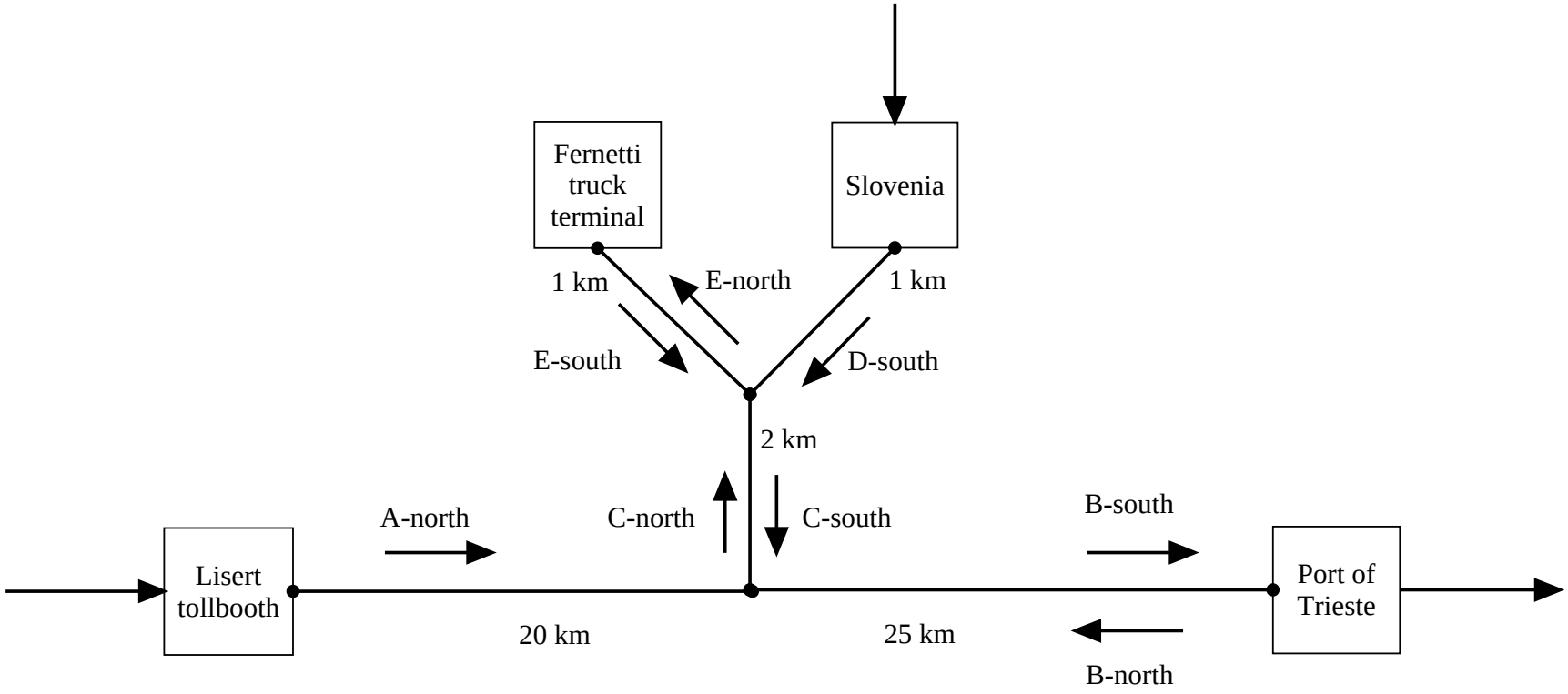
Case study: the Port of Trieste

- Management of the **truck traffic** referred to the Port of Trieste, in particular the ferry service between Trieste and Turkey
- The system is modeled and simulated in **different conditions** characterized by a different **level of information** that is shared between infrastructures and transport operators

Schematic description



The objectives and the solution method

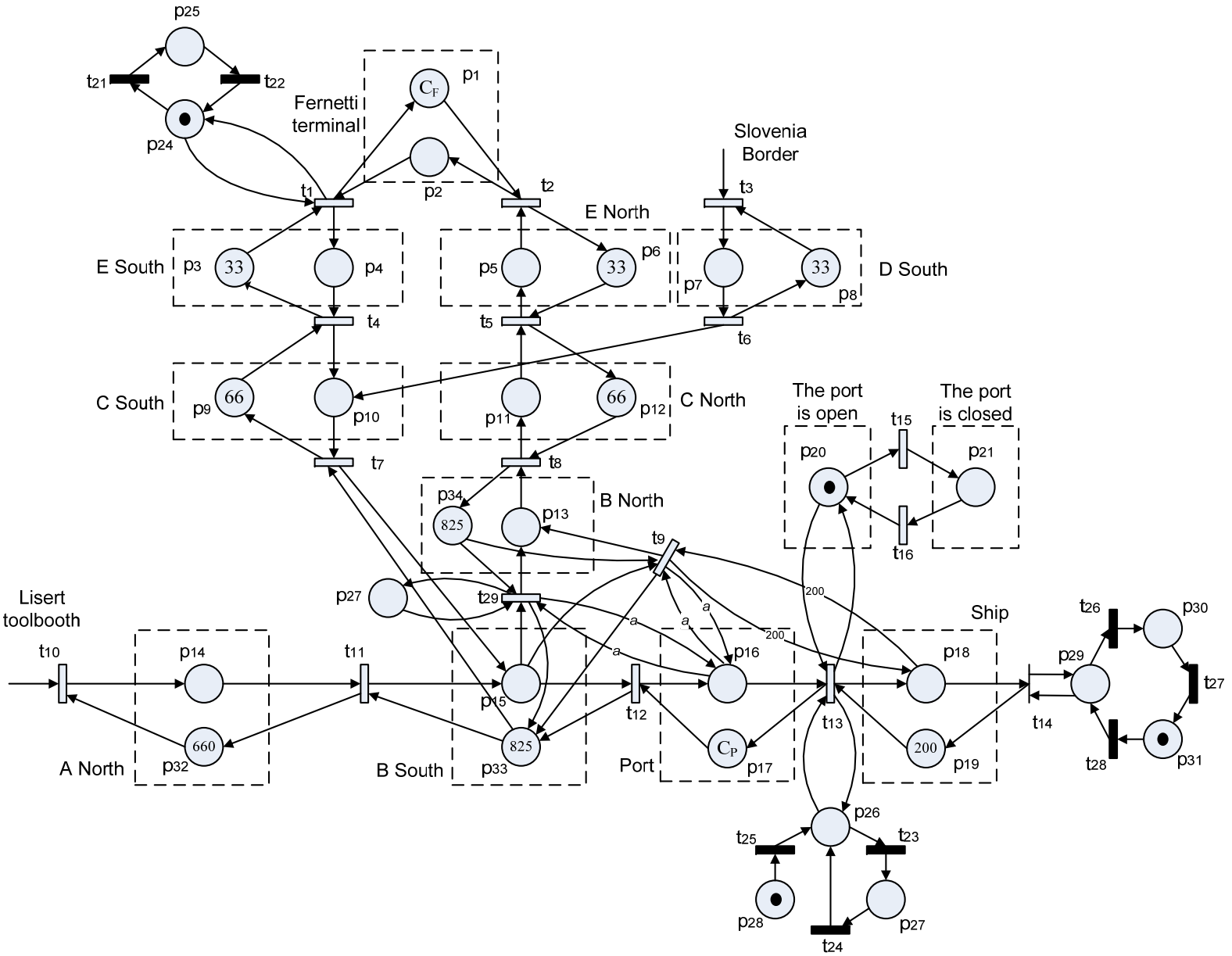
Objectives :

- **Decreasing** the truck traffic in the port area in order to:
  - Limiting pollution
  - Decreasing travel costs
  - Increasing road safety
- Evaluated solutions
  - Increasing the **parking areas** of the port and of the Fernetti Terminal
  - Increasing the **ICT integration** and informations among the logistics actors.

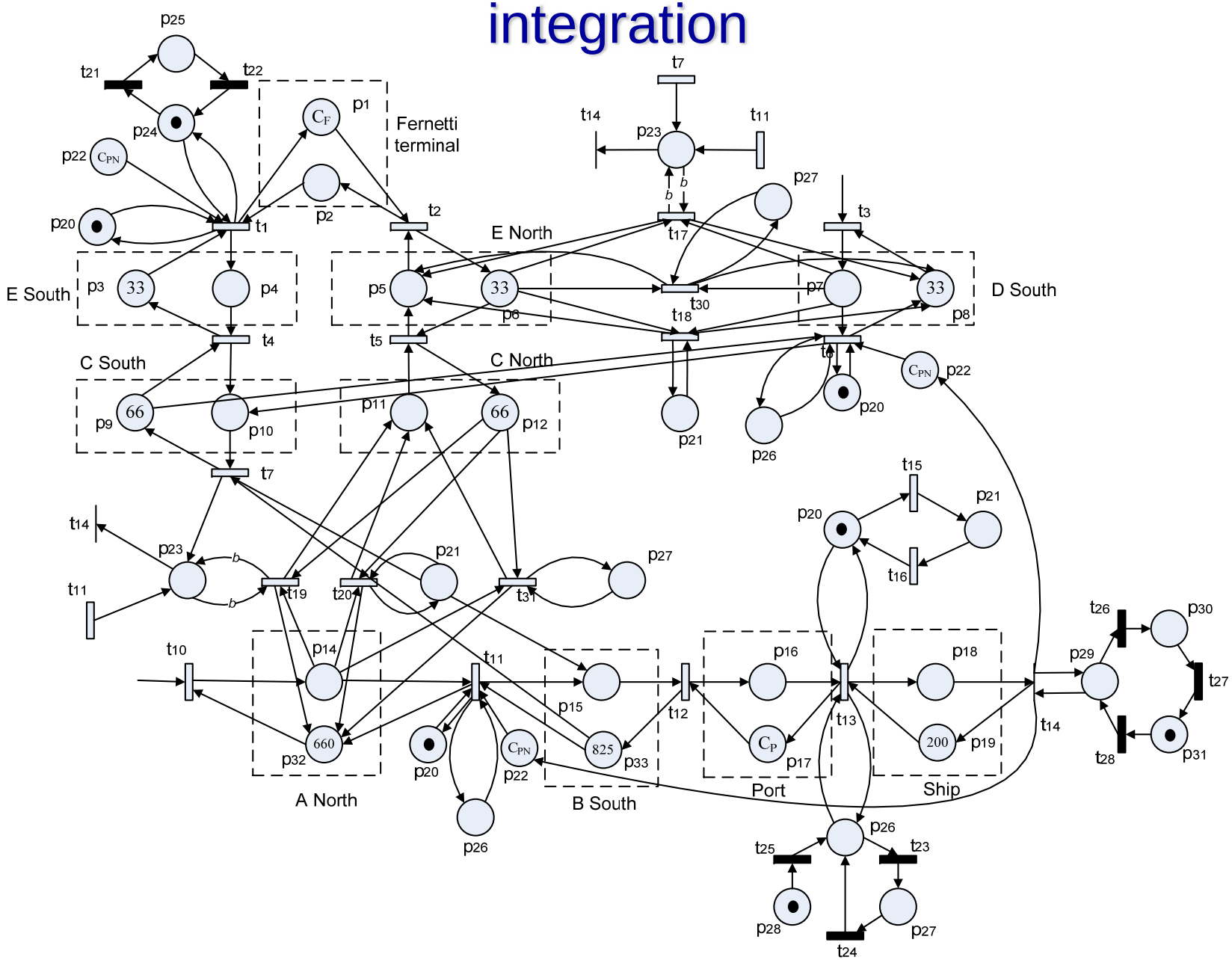
The port is analyzed in four operative conditions

- The actual management of the port logistics (the actual capacities of the port and of Fernetti terminal, no information about the port and ship occupation).
- Larger capacities of the port and Fernetti terminal (no information about the port and ship occupation)
- ICT integration (the actual capacities of the port and of Fernetti terminal).
- Larger capacities of the port and Fernetti terminal with ICT integration

The timed PN model of the system



The timed PN model of the system with ICT integration



The Performance Index

Traffic cost index

We consider the subsets of transitions modeling the paths of the trucks T_H

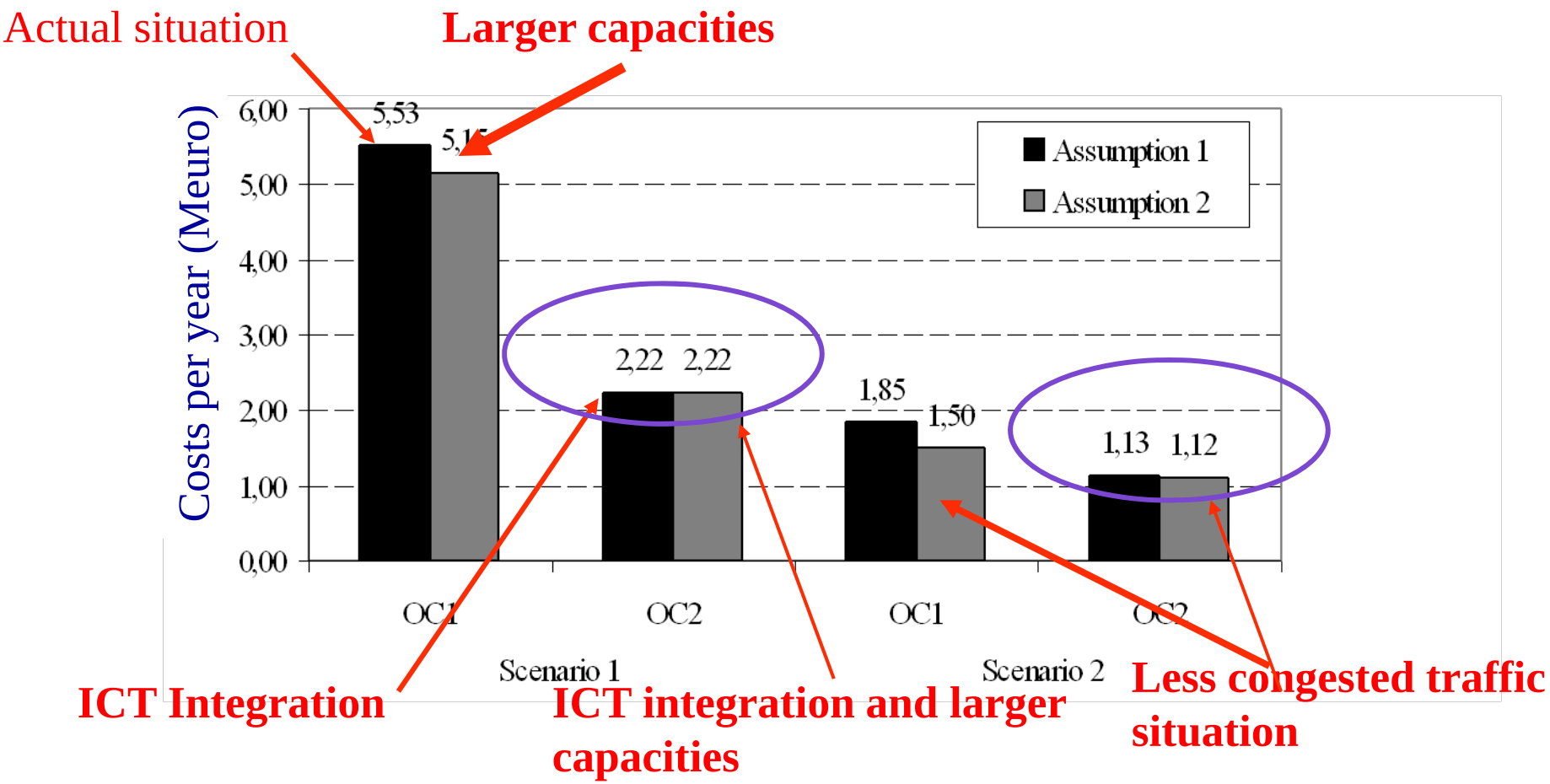
We associate with each transition $t_i \in T_H$ the length $L(t_i)$ of the corresponding highway.

The average traffic cost C is:

$$C = \sum_{t_i \in T_H} TR(t_i) \cdot L(t_i) \cdot A \cdot S \text{ [€/year]}$$

where $TR(t_i)$ is the average throughput of transition t_i, A=8760 h/year is the number of hours in one year, while S is the cost in €/km associated to one truck.

Simulation results



Conclusions

A feasibility study of the integrated ICT-based logistics system for the Italian region Friuli Venezia Giulia is performed in order to increase the efficiency of the regional system and to support intermodal transport.

Four minimal specific functions are singled out:

- information about the state of the infrastructures
- management of hazardous materials
- management of papers via telecommunication devices
- sharing data among transport operators about tracking and tracing of vehicles and goods

Conclusions

We face the problem of the implementation of the first function: the information about the state of the infrastructures.

We analyze the case study of the port of Trieste and we model the system in a Petri net framework.

The simulation results show that an integrated ICT-based system could reduce the traffic congestion and the connected costs.

Systems, Man, & Cybernetics Society

IEEE

The IEEE Italy Chapter of Systems, Man and Cybernetics announces:

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Milan, Italy

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The second workshop was:

ICINCO 2008

5th International Conference on Informatics in Control, Automation and Robotics

11 – 15 May, 2008 Funchal, Madeira – Portugal

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14 - 15 May, 2008 - Funchal, Madeira - Portugal

In conjunction with the 5th International Conference on Informatics in Control, Automation and Robotics - ICINCO 2008

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Background and Goals:

In recent years, the growing role of informatics in controls is probably most evident in automotive applications. The increasing complexity of modern automotive systems often calls for computational intelligence approaches, where traditional control methods are infeasible, ineffective or not economical. Furthermore, with the proliferation of drive-by-wire technologies, advances in sensory, navigation, and wireless communication infrastructure, vehicle controls can now take advantage of the information regarding the state of an environment and a driver, implementing functionalities that are commonly referred to as intelligent. The goal of this workshop is to bring together representatives from academia, industry and government agencies to exchange ideas on state of the art intelligent vehicle systems and future trends. We welcome both theoretical and practical papers, from all areas relevant to application of computational intelligence in vehicle controls and implementation of intelligent vehicle functionalities. Specific topics of interest include, but are not limited to:

- Neural/Fuzzy Controls
- On-board diagnostics
- Active safety systems
- Communication Technologies
- Navigation and Guidance
- Vision-based Applications
- Speech Interface

Facts About SMCS

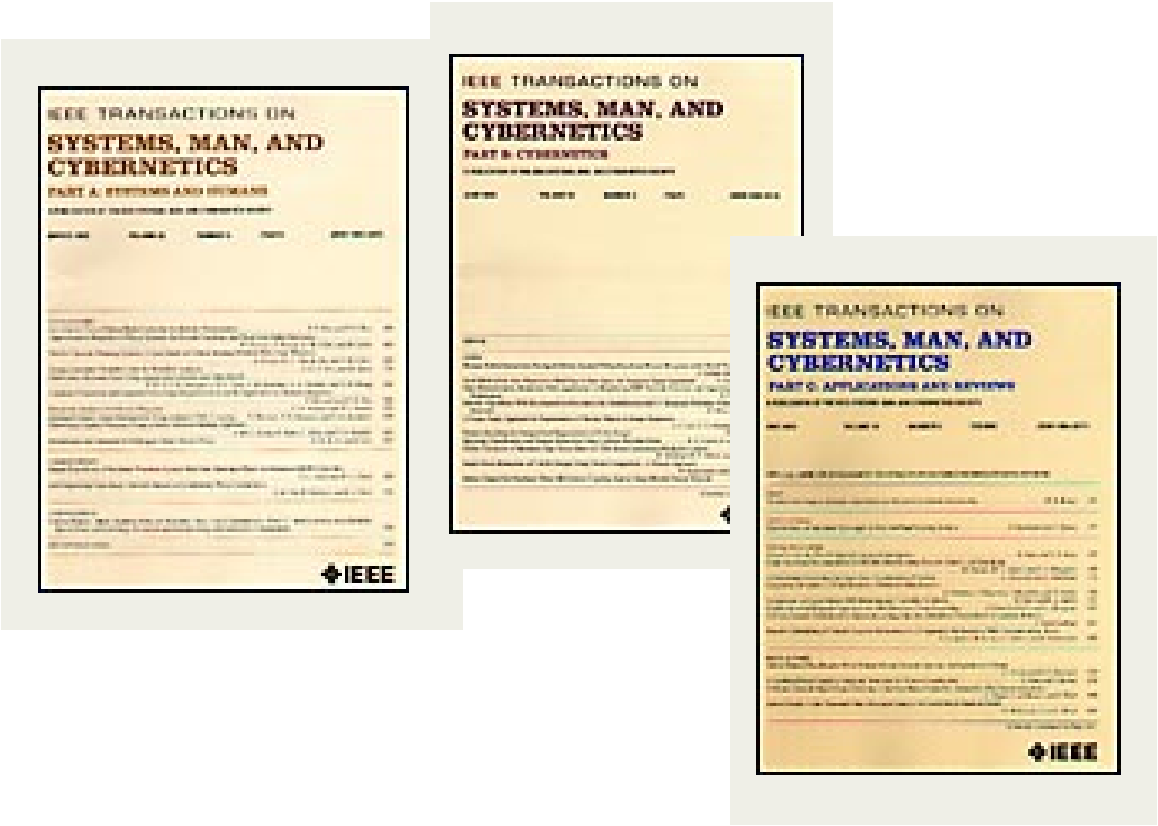
- **Field of Interest**

  Development of systems engineering technology including problem definition methods, modeling, and simulation, methods of system experimentation, human factors engineering, data and methods, systems design techniques and test and evaluation methods.

  Integration of the theories of communication, control, cybernetics, stochastics, optimization, and system structure towards the formulation of a general theory of systems.

  Application at hardware and software levels to the analysis and design of biological, ecological, socio-economic, social service, computer information, and operational man-machine systems.

SMCS Publications



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