Information Systems 01PDWOV

18 june 2015

Books, notes are not allowed. Write only on these sheets.

Metro transport ticketing. A metropolitan transport company manages, at the level of a metropolitan area, transport vehicles (trams, buses, metros). A key issue is managing the processes related to ticketing (issue a ticket and receive payment, control access to vehicles, define and enforce pricing policies, etc).

The company METROT manages a transport system in a city similar to Turin (2 metro lines, around 50 bus / tram lines, around 3000 trams/ buses, 200Million person-trips per year).
In company METROT ticketing is managed as follows (AS IS situation): the ticket is paper based, with a magnetic stripe, and of many types: 90' validity, daily, weekly, monthly validity. The magnetic stripe contains the type of ticket, and stores the time it is used for the first time and possibly other needed information.

Tickets are sold in a number of shops (newsstands, tobacco shops, etc) not owned by METROT, and in around a dozen of METROT retail centers. (Tickets are NOT sold on board of vehicles). Access to vehicles is granted by a machine that reads the ticket (using the magnetic stripe) and writes on it (both on the magnetic stripe, and via ink on paper) information needed to monitor the use of the ticket (ex. for a 90' ticket the time of first use).
A controller can verify if a person has the right of traveling by checking the ticket. When a paper ticket has been used, it can be thrown away.

The TOBE situation uses RFID cards instead of paper / magnetic tickets. Vending machines (installed in stations or in retail shops) issue and/or (re)charge the card. Other machines on board of vehicles read (by proximity) the card and grant access to the vehicle. Similarly do the controllers aboard of vehicles. The RFID card is meant to be used for a long time.

Design the TO BE processes related to ticketing. Do not forget that the new ticket allows, in principle, more flexibility and more control: analysis of the flow of traffic (if every user checks in at the start of the trip and checks out at the end of the trip), internet sales (payment via internet and later writing on the RFID in a machine at a station), user profiling, and so on.

1   IT Model / Technological model: describe the hardware architecture of the system

Client:
       PCs for employees of METROT
       PCs / smartphones for customers
       Machines for check in / checkout of customers (at stations / on vehicles)
       Machines for control of customers , for controllers
       Vending machines

Server
       Database with tickets, trips, tariff policies

2 Organizational model: list roles or organizational units involved

Customer (using RFID card)
METROT
 Sales office (shop of MEtroT that directly sells tickets)
 Shop (not owned by MetroT) that sells tickets on behalf of MEtroT
 Web site (to sell tickets, provide info, control credit on card, etc)
 Sales direction (to monitor sales and usage, to change tariffs)
 Operation direction (to monitor usage, traffic)
 Controller (to control tickets)

3 Functional model: Design and model (using UML activity diagrams with swimlanes + class diagram) the ticketing process (subdividing it as needed in subprocesses)
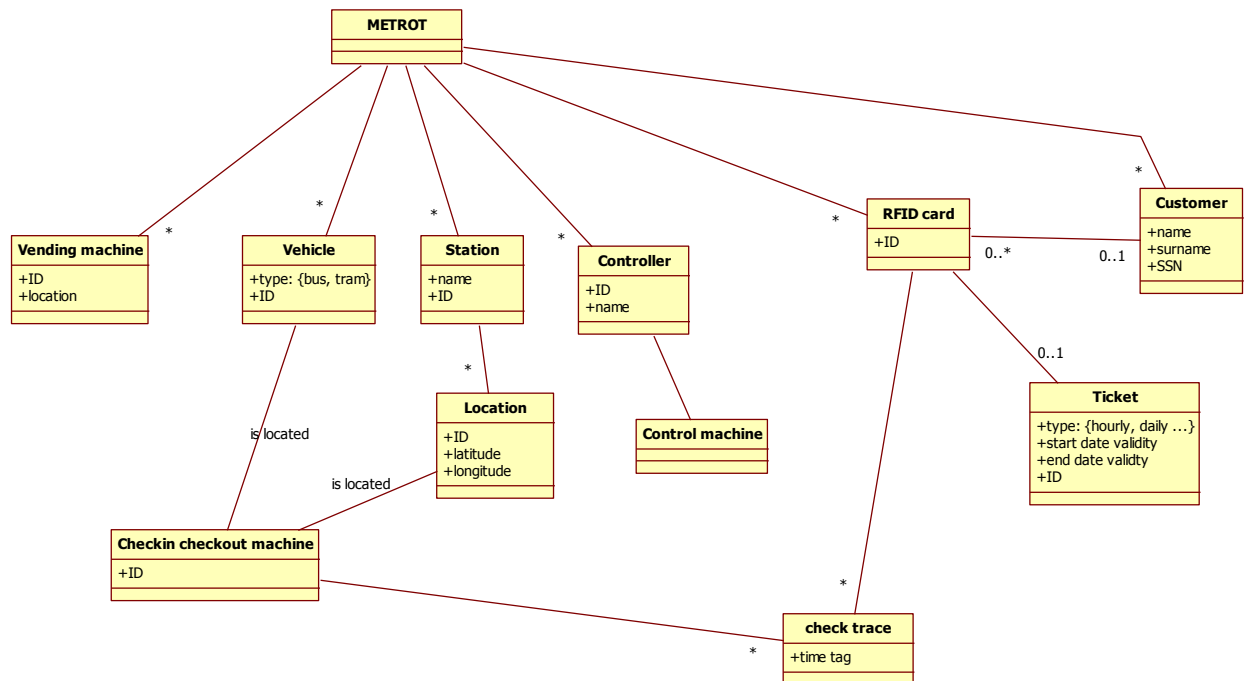
Processes
 Ticket sale, vending machine
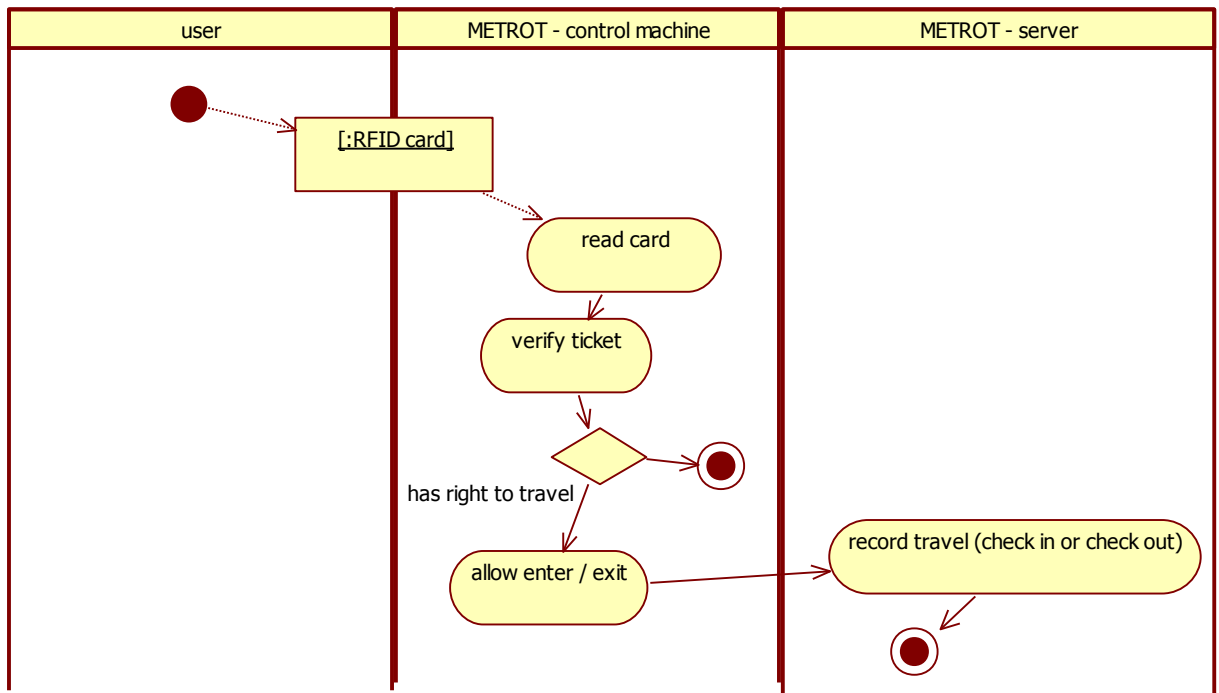 Ticket sale, shop
 Ticket sale, internet
 Travel (check in check out)
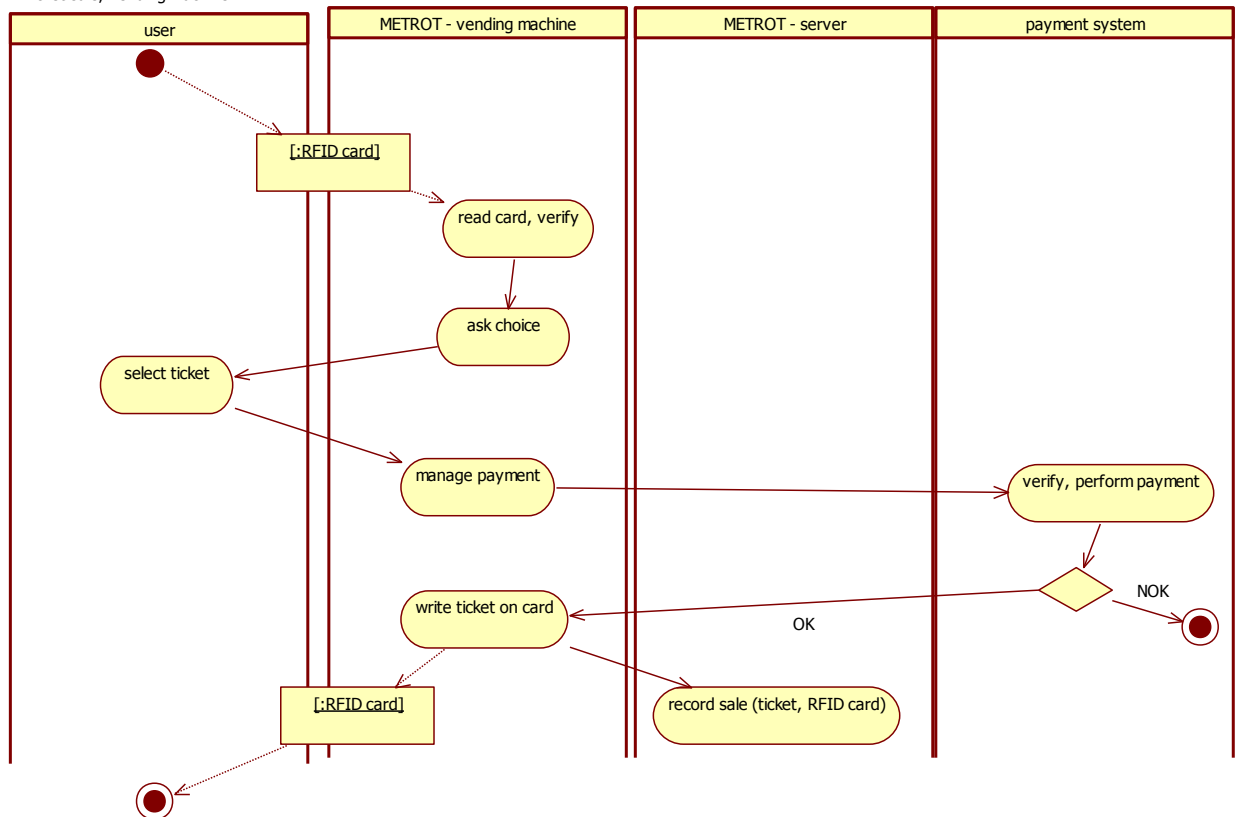 Monitor flow of traffic
 Monitor sales
 Change tariffs

Check in for travel

user	METROT - control machine	METROT - server

[:RFID card]

read card

verify ticket

has right to travel

allow enter / exit

record travel (check in or check out)

Ticket sale, vending machine

user	METROT - vending machine	METROT - server	payment system

[:RFID card]

read card, verify

ask choice

select ticket

manage payment

verify, perform payment

NOK

write ticket on card

OK

[:RFID card]

record sale (ticket, RFID card)

3

4 Define the KPIs, considering these high level business goals (or CSF), CSF1 increase user satisfaction, CSF2 minimize cost of the ticketing process, CSF3 improve control of traffic. In the table below show the correspondence CSF – KPI

CSF name	KPI Category (General, cost ..)	KPI Name	KPI Description	Unit of measure
	general	N_T	Number of tickets issued per year, per type	
		N_RFID	Number of RFID cards issued (per year and overall)	
CSF3		N_trips	Number of person trips per year	
CSF2	efficiency	C_T	Cost of issuing a ticket (paper or rfid card, machines, personnel)	Euro
CSF2		C_C	Cost of controlling tickets /of controlling check in check out (personnel, machines)	Euro
CSF3		C_Non_T	People travelling without ticket, per year (loss of revenue)	Euro
CSF1	Service	L_T	Lead time to issue a ticket the first time, per type	T
CSF1		L_C	Lead time to recharge a ticket (for long term tickets, weekly, monthly etc)	T
CSF1, CSF2	Quality	E_T	Errors in tickets issued / reissued	
CSF3		P_N_trips	Precision of N_trips	
CSF3		P_C_NOnT	Precision of C_Non_T	

5 Compare the previous and the current situation, using the KPIs defined above

KPI	AS IS	TO BE
N_T		May increase if C_Non_T decreases
N_TRIPs	Not measured, only estimated (no checkout)	Measured
C_T		Requires TCO analysis. May decrease on the long run, but requires initial investment
C_C		Requires TCO analysis. May require less controllers, but requires more machines
C_non_T		May decrease, but uncertain. Anyway hard to measure
L_T		Probably unchanged, requires to collect the physical RFIDcard, same as collecting paper ticket
L_C		May decrease if customers use internet
E_T		Probably unchanged. However RFID card more reliable than magnetic stripe for storing information
P_N_trips P_C_NOnT		Should increase, because of check out on machines

6 Define the TCO for the METROT to shift to the TO BE situation

Phase	Cost
Construction C_c	Vending machines, checkin checkout machines in vehicles and stations, network, information system
Deployment C_d	Install machines – train personnel
Operation + maintenance C_o + C_m	Repair defects on machines (hardware), repair software defects and upgrade firmware
Dismissal	Dismount and dispose machines

The main cost item in all phases are the machines (thousands of) and vending machines (hundreds)

7 Considering a 5 years period, define costs and savings (ROI analysis) by adopting the TO BE situation

Year/ cost or saving	Year 1	Year2	Year3	Year4	Year5
	C_c C_d				
	C_o + C_m	C_o + C_m	C_o + C_m	C_o + C_m	C_o + C_m
	S	S	S	S	S

S could come from:
Reduction of kpi C_T , due to
- reduced maintenance cost of check in checkout machines (current machines have magnetic contact points and printers/ ink – new machines are contactless and have no printers)
- reduced personnel effort (internet sales instead of Metrot sales offices, or sales commission to external shops)

Reduction of kpi C_C (uncertain)

8 Considering the KPIs and the ROI, is the TO BE situation better? (answer Yes or No):

Why? yes

The TO BE is definitely better on the capability of monitoring traffic flows and possibly of reducing people travelling without tickets. It should also improve quality of service for customers (faster recharge of tickets via internet).
The TO BE situation may have a positive ROI, but this is difficult to estimate.
In general the transition to RFID cards happens anyway when the previous infrastructure (based on magnetic stripes cards) has to be replaced because of obsolescence. RFID cards compete with other technologies (ex NFC on mobile phones) that may replace (or complement) it.

9 In the METROT case RFID cards to support ticketing are of two types: anonymous (for short life tickets) and personal (with picture and name of owner – for long term tickets). The production and customization of these cards is made by company CARDS-T. What SLA (service level agreements) would you use to monitor and control CARDS-T ?

Unit price of card
Lead time (from order to delivery)
Conformity (number of defective cards / total)
Protection of privacy of data (names, pictures of customers)

10 Propose an organization chart for METROT (around 50 administrative people, 2000 drivers, 50 mechanics for maintenance). Write clearly what organizational model you use.

Given the medium size and the product (one product with little innovation levels) the organization could be functional: sales (ticketing, tariffs, sales); production (management and maintenance of vehicles, lines, drivers); human resources, administration. A design office could be in charge of designing and adapting the product (bus / tram lines and services). An IT office could be in charge of IT support and technologies in general.

Another option is to have a divisional organization (metro, buses, trams). However this leads to the risk of offering not integrated services. But different systems (especially the metro) have different problems and require different skills.
A reasonable option is to have a functional organization, with production unit split in three (bus, tram, metro).

11 Consider a retailer (Walmart, Auchan, Carrefour or similar). What are the main high level business processes they have to set up and operate?

See slides

12 What are the main points of Agency theory?

See slides