The Stockholm Congestion Charging Trial

BACKGROUND »»
Situation in Stockholm

Inhabitants
- 1.9 million in the county of Stockholm
- 760,000 in the city of Stockholm
- 275,000 in the Stockholm inner city

Travel & transportation
- 560,000 vehicles cross the inner city cordon per working day
- 73% of all personal trips across the inner city cordon during rush hour is by public transport
- 2.5% car ownership increase per year
- Lack of capacity in between the northern and the southern halves of the region (road and rail)
Situation in Stockholm

External impacts

- Congestion estimates cost 600 to 800 million Euro per year
- 361 severely injured & 18 traffic deaths
- 10 – 100 cases of cancer caused by atmospheric pollution
- 50 000 inhabitants exposed to over 65 dBA
Situation in Stockholm
Objectives

- Reduce congestion – reduce traffic volume by 10 – 15% during rush hour
- To improve accessibility for buses and cars in the inner city
- Improve the environment
The Stockholm Trial – 4 Parts

Road Administration
Congestion Charges
System Owner
Information how to pay tax

IBM
Design, Build & Operate
the solution and
all processes

SL
Public Transport Operator

The city of Stockholm
Procurement
General Information
Evaluation Program
Park-and-Ride

BACKGROUND
Congestion Charges Trial Period

- Trial period January 2006 – July 2006
- Referendum September 2006
- Decision about making the system permanent or not
Charging Schemes Design

- Charges in both directions
- Exempted traffic
  - To and from the Lidingö islands
  - Emergency vehicles
  - Vehicles with disability permits
  - Foreign cars
  - Buses over 14 tons
  - Taxis
  - Motorcycles
  - Environmental vehicles
Pricing approach for redistributing traffic

- Variable charges
- No charges during low traffic periods
- Max charge 60 SEK per day (6 Euro)
The Stockholm Congestion Charging Trial

Like establishing a new Company »
Solution Complexity

Volumes
- 350,000 passages per day
- 850,000 photos per day
- 110,000 payments per day
- 10,000 - 2,000 calls per day

Performance
- 99.96% system availability
- Very low number of failed charges

Scale
- 1,000,000 user accounts
- 430,000 distributed transponder
- 81 charged lanes
How does it work?

Call-centre operations managed by IBM

Information is matched with registered vehicle. Fee is added to the owner’s account

The gateway registers the vehicle

IBM has designed, built, implemented integrated and runs the congestion charging system

Way of payment
- Transponder/direct debit
- Bank/Giro
- 7-eleven/ Pressbyrån
Equipment
Vehicle identification process

- Height to Registration Unit suspension point
- Distance defined by detection sensor bracket
- Distance between center of gantry and equipment suspension points
- Minimum headroom
- Height to Radio Communication equipment suspension points
- Height to detection sensor suspension points
- Distance between center of gantry and equipment suspension points
- The Switch (S) shall be mounted above and not more than 500 mm from the TXes (not applicable for MR)
- Distance between suspension point of Registration Unit and center of middle gantry
- Distance between suspension point of Registration Unit and center of middle gantry
The Stockholm Congestion Charging Trial

RESULT – TRAFFIC IMPACT »
Road traffic down 20-25%
Exceed all expectations

Improvements also for non car users

- 40,000 new daily public transport passengers
- Time tables for inner city buss has to be redesign due to the increased average speed
- Inner-city retailers trade up 6%
- Attitudes has changed from negative to positive
Redistributed traffic from the peak

![Graphs showing traffic distribution](attachment:image.png)

- **Avgiftssnittet in mot staden** - antal bilar som passerat under vardagar (medelvärde)
- **Avgiftssnittet ut från staden** - antal bilar som passerat under vardagar (medelvärde)
The Stockholm Congestion Charging Trial

DESIGN & IMPLEMENTATION »
## Stockholm Congestion Charges

### A holistic business approach

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<thead>
<tr>
<th>IBM</th>
<th>Marketing</th>
<th>Customer Management and Care</th>
<th>Billing and Collections</th>
<th>OEM Production &amp; Fulfillment</th>
<th>Service Management</th>
<th>Service Delivery</th>
<th>Business Management</th>
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<tbody>
<tr>
<td>Control</td>
<td>Brand Management</td>
<td>Manage customer service operations</td>
<td>Billing &amp; Collections Management</td>
<td>OBU Production Planning</td>
<td>IS / IT Support Services Plant</td>
<td>Programme &amp; Project Mgmt</td>
<td>Strategic Enterprise Planning</td>
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<td></td>
<td>Marketing &amp; Communications Management</td>
<td>Account Management</td>
<td>Profit Management</td>
<td>OBU Purchasing and Inventory Management</td>
<td>Customer SLA / OBU Mgmt</td>
<td>Programme &amp; Project Mgmt</td>
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<td></td>
<td></td>
<td>Web content mgmt</td>
<td></td>
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<td></td>
<td>Programme &amp; Project Mgmt</td>
<td>Programme &amp; Project Mgmt</td>
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<tr>
<td>Execute</td>
<td>Marketing Research and Analysis</td>
<td>Customer Contact Operations</td>
<td>Biller and Taxation Passages</td>
<td>OBU Production</td>
<td>Service Problem and Incident Mgmt</td>
<td>Solution Design</td>
<td>Accounting &amp; Ledger Operations</td>
</tr>
<tr>
<td></td>
<td>Execute information and marketing campaigns</td>
<td>Registration</td>
<td>Billing</td>
<td>OBU Logistics and Distribution</td>
<td>End to End Solution Monitoring</td>
<td>Solution Design</td>
<td>Accounting &amp; Ledger Operations</td>
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<td></td>
<td></td>
<td>Enquires</td>
<td>Collections</td>
<td>OBU Device Installation</td>
<td>System, Network &amp; Infrastructure Operations</td>
<td>Solution Design</td>
<td>Knowledge Asset</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Problem Resolution and Resolution</td>
<td>OBU Returns and Service</td>
<td>OBU Device Installation</td>
<td>Configuration Mgmt</td>
<td>Release &amp; Test Installation</td>
<td>Knowledge Asset</td>
</tr>
<tr>
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<td>Appeal handling</td>
<td>OBU Production and Service</td>
<td>OBU Device Installation</td>
<td>Asset Mgmt</td>
<td>Knowledge Asset</td>
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</tr>
</tbody>
</table>

**DESIGN & IMPLEMENTATION**
Responsibility from end to end

- What's the frame work?
- What needs to be decided?
- How are we going to control the performance?
- How are we going to execute the operation?
- How can we organise the system in the most efficient way?
Architecture Overview

USF Copenhagen

E2E Monitoring

Vehicle owner

Customer Service

Internet

Extranet

SAP
CRM
FI-CA
BW

Integration Hub

Preprocessor
OCR

Transaction Store

Web Portal

Detailed Transaction database

MLC

Storage

Images Store

Local Vehicle Database

Charging points

MLC

Roadside

Extranet

Citrix

Scheduling

External Systems

E2E Monitoring

USF Copenhagen

Transaction Store

Web Portal

Integration Hub

Preprocessor
OCR

Detailed Transaction database

Images Store

Local Vehicle Database
24 Hours Operational Cycle

- Backup
- Car Registry Update
- Direct Debit
- Business Warehouse Update
- Dunning
- Tax Decision
- Payment Lot
- Web + Payment
- Capturing Passage Data
- Payment Files
- Preprocessing and OCR
- MCR and Predunning Verification

START
We redesigned the solution a number of times!

**Major challenges to overcome**

- IBM got the responsibility from end to end
- Coordinate the large number of partners
- Manage the large number (500) of change requests
- Optimise the system design to meet the aggressive service levels
- Manage all data processing within a 24 hour cycle
- The system had to be up and running 3 Jan 2006
- Publicity
Reality VS Expectations

A normal day at work

- Calls to the call centre  2,000   (30,000)
- Charged passages  350,000   (500,000)
- Tax decisions  110,000
- Reminder letter 1  3,650
- Reminder letter 2  1,200
- Complaints on charges  100   (1,000)
- Legal appeals  6
Extensive media coverage

Some weeks after
System performance exceeds all expectation
Joint forces

Number of people involved

IBM: 200 people
Client: 50 people

All together: 14 nationalities
11 partners
4,000 people
Extensive media coverage

Before the launching date
Solution, transponders and project costs
Extensive media coverage

System launching day
Focused on the expected chaos
Extensive media coverage

One day after
Immediate positive press focused on the huge impact
The Stockholm Congestion Charging Trial

BENCHMARKING »
### Charging schemes in other cities

<table>
<thead>
<tr>
<th></th>
<th>Singapore</th>
<th>Oslo</th>
<th>London</th>
<th>Stockholm</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Objective</strong></td>
<td>Optimize the usage of road infrastructure.</td>
<td>Fund new road &amp; public transport infrastructure projects</td>
<td>Reduce congestion 15% and fund investments in the London transport system</td>
<td>Reduce congestion 10-15%, improve the environment and fund increased public transport and Park&amp;Ride</td>
</tr>
<tr>
<td><strong>Pricing scheme</strong></td>
<td>€0.2 per in bound trip; variable charge Monday to Friday 8:00 to 19:00</td>
<td>€1.5 per inbound trip; flat rate all days</td>
<td>€10 area charge per day, flat rate Monday to Friday 7:00 to 18:30</td>
<td>€1.2 per in and outbound trip; variable charge Monday to Friday 6:30 to 18:30</td>
</tr>
<tr>
<td><strong>Payment</strong></td>
<td>Pre payment Cash card and DSRC</td>
<td>Pre payment via DSRC or manually at road side</td>
<td>Pre payment manually</td>
<td>Post payment via DSRC &amp; direct debit or manually (giro or retailer)</td>
</tr>
<tr>
<td><strong>Enforcement</strong></td>
<td>Camera and ANPR</td>
<td>Camera and MCR</td>
<td>Camera and ANPR</td>
<td>Camera and ANPR</td>
</tr>
<tr>
<td><strong>Revenue per year</strong></td>
<td>€40M</td>
<td>€130M</td>
<td>€270M</td>
<td>€85M</td>
</tr>
<tr>
<td><strong>Future</strong></td>
<td>GPS based system considered</td>
<td>Extension and variable pricing scheme considered</td>
<td>Western extension, DSRC pilot project</td>
<td>Referendum to decide to permanent or not</td>
</tr>
</tbody>
</table>
A combination of economic trends and policy trends make the transport system inefficient, and there is no immediate relief in sight.
IBM Vision for Europe – towards national road charges (cordon and distance)

Inter-urban road tolls
Tunnels & Bridges
New/wider roads

Congestion charging
Lorry road user charging

All vehicles/ All roads
Differences and similarities

Solutions looks the same but are different
- Oslo don’t charge congestions
- London don’t have transponders
- Stockholm is a “state of the art” solution built on proven technology
- Singapore consider GPS solution for the future
Costs

What's driving the total cost?
- Exemptions rules
- Service levels
- Payment rules
- Transponders
Road Charging – Why IBM

IBM uses innovation to meet the functional objectives.

IBM has the ability to build, design and operate one of the most complex IT solutions via our skills within consulting, IT outsourcing and process outsourcing like call-centres & payment processes.
Road Charging – Why IBM

Managing complexity
- Holistic approach
- Experience
- IBM Research
- Security/privacy
- Technology evolution
- Open standards
The solution is good but not perfect
Contact details – Reference case contact

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- **Videos**  
  - Winning the Road Game  
  - Stockholm Congestion Charging Trial

- **Planned RUC seminars**  
  - Urban Futures conference, Stockholm May 3-5  
  - Impact Conference, Stockholm June 29-30

- **Stockholm VIP client demonstrations**  
  - Road side equipment (Bus tour)  
  - Call centre  
  - Central system

- **White Papers / Leaflets**  
  - Driving the future of road user charging  
  - Congestion Charging White Paper  
  - Stockholm Congestion Charging Trial leaflet

- **RUC Knowledge card (IBM internal)**
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