DataMOCCA

DATA MOdel for Call Center Analysis

Volume 1

Model Description and Introduction to User Interface

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The DataMOCCA Project is an initiative of researchers from the Technion - Israel Institute of Technology and The Wharton School – University of Pennsylvania. The mission of the project is to collect, pre-process, organize and analyze data from Telephone Call/Contact Centers. The raw data obtained are call-by-call records of at least one year's duration from active Call Centers. Among the goals of the project are the development and distribution of Call Center databases, using a uniform schema. The data repository created, together with software tools, will be accessible through the world-wide-web and provide a resource for researchers and teachers of Service Engineering, Science and Management.

List of Documents

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1	Model Description and Introduction to User Interface	July 29, 2006
2.1	Summary Tables Variable Definitions – USBank	
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Contents of Volume 1

1 Introduction

This document describes a DATA MOdel for Call Center Analysis (**DATA MOCCA**). The model has been developed in order to facilitate statistical analyses based on individual call (that is, call-by-call) data from a Call Center. The model accommodates Call Centers consisting of either a single-node or of multiple nodes (i.e., with a multiplicity of logical and/or physical components).[*] It is expected that our model will be useful for other environments in which the history of individual customers is traced, for example hospitals equipped with RFID monitors.

Historically, empirical and statistical analyses of call center operations have been almost exclusively restricted to summary data tables, which are supplied by application (e.g. ACD) software. These summaries do not allow for analyses of individual calls, and so, for example, do not allow one to deduce information on customer patience or retrial behavior.

Empirical and Statistical analyses of operational Call Center Data, based on call-by-call data, are:
http://iew3.technion.ac.il/serveng2006W/References/JASA_callcenter.pdf
http://iew3.technion.ac.il/serveng2006W/References/ccdata.pdf

The aims of the DataMOCCA research project are to provide the infrastructure for, as well as to conduct, analyses based on individual call histories. The need for a formal data model for this task stems from the following two major considerations:

- The raw data, as dumped by commercial call routing and recording systems, are not readily amenable to most analyses, and the summary statistics that they supply are not adequate for studying customer and agent behavior patterns;
- For comparative and generic studies, it is important to have a data model that is as independent as possible of the particular source data format, and one which may eventually become a standard for analysis of Call Center data.

Beyond the data model and the database, we have also developed and implemented a user-friendly real-time interface tool called **STATCCA**. With typical few-seconds response times, this tool extracts data and produces descriptive statistics (via EXCELL tables/graphs and POWERPOINT displays). Currently, STATCCA creates three types of summary data: daily summaries (resolution from 1 second through hours to days), time-series summaries (resolution of 1 day over months or years), and daily call-flow reports. STATCCA is discussed in Appendix 3.

It is important to emphasize that building a database in practice involves considerably more effort than merely applying a (conceivably automated) mapping of raw input records into output records. In our experience, based on several such real raw data

[*] A survey of Call Centers research can be found at
http://iew3.technion.ac.il/serveng/References/Gans-Koole-Mandelbaum-CCReview.pdf
A comprehensive bibliography of Call Center papers (including their Abstracts) is
http://iew3.technion.ac.il/serveng/References/ccbib.pdf

sources from quite different organizations, a very significant time-consuming data-cleaning effort is required in order to reconcile the many inconsistencies that occur in the raw data records.

In one case, for example, activity or application codes – critical for classifying service types – were allocated and re-allocated several times during the data collection period (30 months). In this case, a separate book-keeping system had to be set up in order to provide consistent and reliable service type information in order to maintain the integrity of the combined data-base.

Since most of the anticipated statistical analyses are based on event times and durations, the accuracy of the recorded times in the raw data is paramount. We have found that time recording errors do occur quite frequently. Some examples of data integrity issues, concerning times as well as other characteristics, that need to be dealt with include:

- dealing with calls that span two days (over midnight);
- dealing with clock re-settings – both accidental and planned such as summer/winter times;
- lack of synchronization between recorded clock times at different locations in the same multi-node Call Center;
- differentiating between calls initiated by customers from those initiated by agents;
- erroneously duplicated records.

It should be emphasized that our data-model incorporates both the customer as well as the agent history associated with each call. Thus statistical analyses can be focused on studying the customers' behavior and experience, or on those of the agents

2 Structure of the Present Document

The remainder of this document is structured as follows. We start with a count-summary of our two call centers.

We present the basic structure of a typical raw data record, and then describe the data-model (relational database) that has been constructed from these records.

3 Summary Data for Two Call Centers

Our data repository currently covers two call centers, one of a medium-sized U.S. Bank (with up to 800 agents working during peak periods on an average day) and the other is an Israeli Telecom Company (around 400 agents).

US Bank (from March 26, 2001 to October 26, 2003)

	Total	Total Weekdays	Total Weekends	Avreage per Year	Average per Month	Average per Weekday
Total # of arriving calls	218,047,488	181,032,004	37,015,484	83,864,418	7,033,790	271,006
# Requesting agent service	41,646,142	37,036,994	4,609,148	16,017,747	1,343,424	55,445
# Served by IVR, Message or Announcement	176,401,346	143,995,010	32,406,336	67,846,672	5,690,366	215,561

Israeli Telecom Company (from January 1, 2004 to November 30, 2005)

	Total	Total Weekdays	Total Weekends	Average per Year	Average per Month	Average per Weekday
Total # of arriving calls	112,488,410	92,882,163	19,606,247	58,587,713	4,890,800	224,976
# Requesting agent service	26,464,119	22,786,824	3,677,295	13,783,395	1,150,614	52,928
# Served by IVR, Message or Announcement	86,024,291	70,095,339	15,928,952	44,804,318	3,740,186	172,049

4 Data processing steps

The data processing needed to produce the DataMOCCA model can be divided into three steps:

Step 1: input raw data records (which are obtained as call *segments*) and output cleaned segment files;

Step 2: convert segment files into an ACCESS data base with 9 tables, which are stored in a separate directory for each day.

Step 3: produce topic specific summary tables for each day (e.g. event counts such as abandonments per time interval, waiting time distributions).

Step 3 can be extended by the user who, with relatively straightforward instructions and SQL statements, can generate further summary tables (see also the STATCCA application in Appendix 3.)

For the most part, the statistical analyst or other interested user can now extract information from the summary tables using the STATCCA tool implemented in the CCA application. This tool produces both graphical and tabular output, conveniently placed in Excel files, and thus available for further analysis and research. The tool is under continual development. Its present capabilities are demonstrated in Appendix 3 and in separate documents listed on Page i.

5 Customer call history and raw call records

A typical description of a call history[†] is as follows. The customer-originated call enters the Call Center system at a particular node, usually via a VRU – Voice Response Unit. In some applications the call may also enter:

- via an Informational Announcement;
- via the Call Center voice messaging system; or even
- directly to an agent service group.

Typically, about 20% of incoming calls seek to speak to an agent, and the remaining 80% are satisfied with self-service transactions conducted or information received at the VRU, Announcement or Message stages.

At the next stage, for the customers who desire to speak to an agent, the call is transferred to be served by an agent who is capable of performing the desired service (has the required skills). The call may either be connected immediately or queued. For some multi-node Call Centers (such as our U.S. Bank), calls may be queued locally for some length of time (possibly zero), after which they will be queued simultaneously at several nodes (interqueue) - each such node having appropriate agents with the required skill-sets. The customer call will then wait until either an appropriately skilled agent at one of the nodes becomes free, or else the customer abandons the interqueue. At completion of service by the agent, the call either ends, or has a continuation. In the latter case, in our data model, the original call is divided into the first customer sub-call which ends when the first service was completed, plus the remainder of the call, which may be divided into further sub-calls. During each of these further sub-calls the customer may abandon, while waiting to speak to the next agent. See Figure 1 for a schematic description (the green line) of a customer call broken into the first and second customer sub-calls.

In one application or study (an application or study refers to a particular Call Center), about 13 – 15% of customer calls that received service by an agent, were then transferred by the agent to the VRU (or Informational Announcement), or to another agent in order to receive additional service.

Within each sub-call, information is recorded in components called segments. These segments make up the physical records originally provided in the raw data. The fixed fields in each segment describe the following characteristics of the segment:

- call id (an identifier of the originating call)
- track id (an identifier of the line that is being occupied)
- segment start and end time stamps
- caller id (possibly coded, or originating phone number)
- answer party id (e.g. VRU or agent code)
- type of service or application

[†] A large part of the following description applies in general to most types of Call Centers. However, each Call Center also has its specific idiosyncrasies. In the sequel, we will typically first describe universally relevant processes and variables, and then give details of those that are specific to given study.

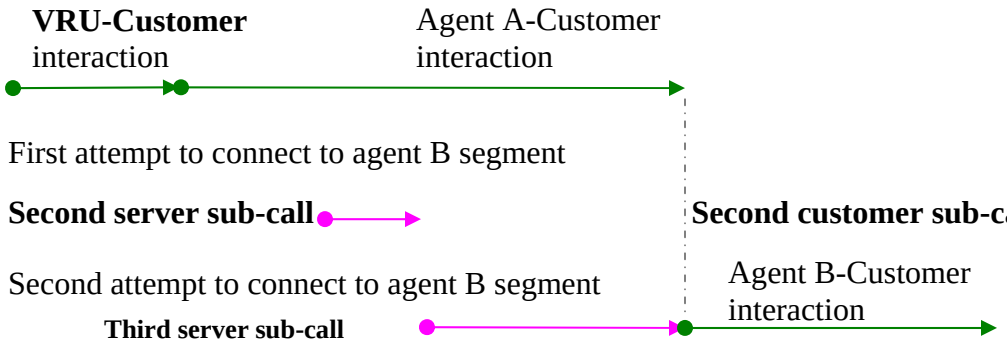
- call type (incoming or outgoing)
- segment component durations – talk time, hold time, ring time, queue time, delay time, wrap-up time …

For example, when an agent is ready to answer an incoming call, there is a *ring time* during which the agent typically receives information about the customer before he actually answers the call. If the agent is being forwarded a call from another agent, there is a *delay time* while the agents converse before the customer is taken off hold and talks to the second agent. Furthermore, after the agent has finished providing active service and the customer has left (disconnected or continued on to the next sub-call), there is the *wrap-up time* during which the agent completes registering the transaction and during which he is not yet free to take a new call.

Thus each original customer call identified by a unique Call-Id at origination, is divided into one or more sub-calls. These sub-calls are, in turn, comprised of one or more segments. The segments, which are delineated by time stamps, describe components of the sub-call such as VRU interaction, Message interaction, Announcement listening, and agent interaction. Calls that seek agent service make up what is called the *offered volume* which is the source of the work load on the agents. A certain proportion of these calls may abandon before actually receiving agent service. Calls that only involve VRU, Announcement and Message segments are not included in the offered volume.

A further level of complication arises from the fact that agents may initiate calls (called *server sub-calls*) while dealing with an external customer's call. This phenomenon is also illustrated in Figure 1 where Agent A is trying to connect a customer with Agent B, and is only successful on the second attempt. This generates two server sub-calls, during which time the customer is on hold.

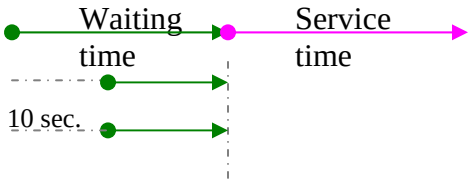
Figure 1: Customer and server sub-calls



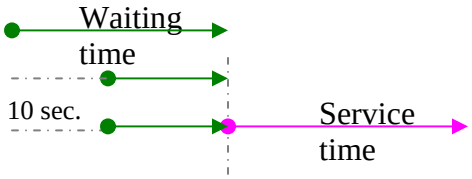
Below in Figure 2, we illustrate three scenarios for a customer call that is directed to the interqueue in a multi-node Call Center network. Note that we have set the delay before placing the waiting call into the interqueue to 10 seconds.

Figure 2: Fate of a Call placed in the Interqueue

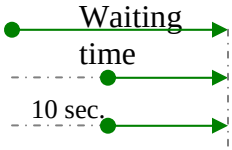
First situation: a call served at the local node:



Second situation: a call served at one of alternative nodes:



Third situation: a call abandoned while in the interqueue:



6 Cleaning the segment file

The first stage in pre-processing the data is to take the raw data files, in which records consist of segments of calls represented by a fixed set of fields, and to clean them. The output is a segment table, for each day, with all the original information, plus sub-call identification as well as a recoded segment outcome field, which provides a uniform determination of the outcome of the segment. The cleaning operation handles over-midnight calls, adjusting time stamps, and checks for *lost* track id's.

A more detailed description of the cleaned segment file fields, for a specific application, is given below.

1. Call Id - Universal identifier associated with the entire call.
2. **Customer sub-call**[*] – Sequence number of the particular service interaction during entire call.

[*] These fields are produced during the initial processing of the raw data to produce the clean segment tables. This processing is carried out month by month, producing segment tables for each day of the month.

3. **Server sub-call*** - Sequence number of sub-call for the server that handled or initiated the sub-call.
4. Node - Identifier of the node where the sub-call is currently being processed
5. Start time – Date and time at which the segment is started, in dd-mmm-yy h:mm:ss AM/PM format.
6. End time - Date and time at which the segment is ended, in dd-mmm-yy h:mm:ss AM/PM format.
7. Call type – The type of the call (Incoming/Outgoing/Internal/Voice Message). The incoming calls that represent about 95% of customer calls are originated outside the system (code 1), the inside calls are received when one uses the inside line key (code 4), the outgoing calls are originated by the system and are directed outside the system (code 5), voice message calls are activated when the agent uses the message key (code 6). Sometimes the call type may be unknown, probably due to a bug in the system, when the first part of the call is lost (code 7).
8. **Segment type*** - The state of the call (Begin/End/Interqueue/Transfer/Outgoing/..). Segment types characterize the state of the call, whether the particular segment is the beginning of the call (code 1) and therefore there would be at least one additional segment that characterizes the end of the call (code 3). The call may contain just one segment, which implies it represents the beginning and the end of the call (code 2). An intermediate segment has code 4. There are segment types that correspond to agent-initiated segments and characterize outgoing call transactions, transfers, calls to a supervisor, or pressing the message or the help key (codes 6-15) – see the example tables in Appendix 1.
9. **Outcome*** – The cause of call termination (Handled/Transferred/ Abandoned/Undefined). In normal situations the segment terminates when a caller hangs up after receiving the service (code 1), or when an agent hangs up after providing service (code 2). The abandon short termination (code 11) occurs when a caller or agent abandons, *within an abandon threshold time*, without re-connecting to a Call Center resource, or a caller hangs up during delay, queue, or ring time. The abandon termination (code 12) occurs in the same situations as described before, but after the abandon threshold time.
10. **Segment parties*** – The type of resource answering the call (Trunk[**]/Primary Agent/ Announcement/Voice message/ Not Primary Agent), see the example table in Appendix 1.
11. Service – The type of service received by the caller. In a particular application there were 6 main service types: Retail, Premier, Business, Consumer Loans, Online Banking and Telesales. The codes of these main service types and the others are given in the example table in Appendix 1.
12. **Service group*** – The service group that handled the call. In a particular application there were 5 main service groups: VRU, Business line, non-Business line, Announcement, Message. The service group, which provides service by human agents, is Business line. The codes of these main service groups and the others are given in an example table in Appendix 1.
13. Ring time – The length of time required for the agent to pick up the call.

[**] Trunk: – describes a segment that indicates that the original call is still active, but the processing is being done elsewhere at that time; usually by another agent at another node, or possibly outside the system.

14. Delay time – The amount of time a caller spent listening to recorded announcements (non-informational) while waiting for an agent.
15. Queue time – The amount of time a caller spent listening to music or silence while waiting to speak to an agent.
16. Call type time – the amount of time an agent spent listening to a call type announcement prior to being connected to the call (whisper).
17. Talk time – the time the caller spent connected to a resource (agent, voice port, announcement, trunk, VRU).
18. Hold time – the amount of time a caller spent on hold on an agent's teleset.
19. Wrap-up time – the amount of time an agent spent in a wrap-up state after the completion of the call segment.
20. Party answered - agent extension number, or trunk ID, or voice port, or information announcement number.

The following fields were not available for every database among the various Call Centers with which we have worked. If they exist, they enable the production of a customer ID (possibly based on a phone number), to identify a port from which the call is originated and the destination port of the same call.

21. Original agent – agent extension number if agent originates call segment, otherwise – 0.
22. Original group – number of the group (an agent group, or trunk group) to which the call originator belongs.
23. Destination group – number of the group (an agent group, or trunk group) to which the call destination belongs.
24. Consultancy agent - agent extension number if agent associates as a third party, otherwise – 0.
25. Dial digit – on outgoing calls, the dialed digits; on incoming calls, the ANI digits received.
26. Application number – application associated with the call segment.

7 Data Model: Access Data Base

The segment table records are then processed to produce 7-9 ACCESS tables for each day, depending on available source data tables. The data base tables produced are listed below:
calls, customer sub-calls, server sub-calls, queue records, event details, agent events, agent profile, agent records, and agent shifts.

1. The **calls** table includes general information on each call that enters the Call Center on a particular day – each record in this table relates to a distinct call.
2. The **customer sub-calls** (cust_subcalls) table includes customer-initiated calls that reach the *offered volume* – each record in this table is associated with a customer sub-call segment.
3. The **queue** (q_records) table includes only the calls that request service from an agent (that is, that form part of the offered volume) – each record is a segment associated with a customer-initiated call. If the call is placed in the interqueue, then a separate segment is generated for each node relevant to that service.

The following tables include the information about the calls that were served at least once by an agent.

4. The **server sub-calls** (server_subcalls) table includes agent-initiated calls that consist of more than one server sub-call – each record in this table is segment associated with a new server sub-call.
5. The **agent records** table includes only the segments of the calls in which an agent was registered as an originating party, or as a destination party, or as a consultant of another agent – the third party. Each record corresponds to a server sub-call. A single customer call might have multiple agent records, and two (or more) agent records within the same call might correspond to the same agent
6. The **agent profile** table has a record for each agent active on a given day – each record describes sign-on/signoff times, duration of idle, available, working/non-working (in the case of several shifts) periods during a day, number of incoming/outgoing/inside/consulting calls taken, number of calls terminated by customer/agent/transfer/undefined, percent of business calls registered, percent of incoming calls terminated by agent after only short-periods of time (Quick-Hang phenomenon).
7. The **agent shifts** table presents the shift ordinal number of agent, shift start and end time, service the agent is skilled to provide, and time intervals between shifts for those agents who operate more than one shift a day.
8. The **event detail** table provides codes for non call-related agent activity during a shift (e.g. idle =4, available =5, sign-on =2, or sign-off = 3 states) by his extension number that identifies the agent (at least for the particular shift).
9. The **agent events** table provides codes for agent activity, for every second during a shift, by his extension number that identifies the agent. The event codes are for idle states, breaks, available state, sign-on states, sign-off states, agent originated call segment, or agent answered call segment.

The following paragraphs are titled using the above table names and include the list of all field names of a given table and their description.

7.1 The calls table

1. call_id - universal identifier associated with the entire call.
2. call_type - type of call transaction (Incoming/Internal/Outgoing call) as determined by first segment of the call.
3. customer_id – customer ID generated from customer phone number.
4. customer_type – type of a phone number registered by a system (1- cellular number, 3 – Bezec number, 4 – others).
5. node - identifier of the site where the call was started.
6. entry_service_group - service group, according to the first segment of the call.
7. entry_service - type of service requested by the caller, according to the first segment of the call.
8. first_service - first type of service requested by the caller from the primary agent.
9. exit_service_group - service group, according to the last segment of the call.
10. call_start - time in seconds[‡] at which the call is started.

[‡] Time in seconds is the time since the origin which is time 00:00:00 on 01/01/1970

11. call_end - time in seconds at which the call is ended.
12. duration – overall time customer spend in the system.
13. queue_entry - time in seconds at which the customer enters the queue.
14. outcome - reason that a call is disconnected, based on last segment outcome.
15. nsubcalls - number of services (sub-calls) that a caller requested during his call.
16. simple - boolean digit assigned to the number of services (sub-calls) (1 - a caller requests one service, 0 - a caller requests more than one service).

From this table, one learns about the event-history of a call, and can study arrival patterns to various service types.

7.2 The customer sub-calls table

Some of the fields are taken directly from the cleaned segments file.

1. call_id - universal identifier associated with the entire call.
2. cust_subcall - sequence number of service that a caller received during his call.
3. server_subcall - sequence number for the server that handled the call.
4. record_id - ID number assigned to the record, and is created uniquely for all segments of particular day.
5. node - identifier of the site where the call is currently being processed.
6. customer_id – customer ID generated from customer phone number.
7. customer_type – type of a phone number registered by a system (1- cellular number, 3 – Bezec number, 4 – others).
8. service_group - service group that handled the call.
9. service - type of service received by the caller.
10. first_service - first type of service requested by the caller from the primary agent.
11. segment_start - time in seconds at which the segment is started.
12. queue_exit – time in seconds at which the call exits the queue.
13. service_entry - time in seconds at which the call enters the agent.
14. segment_end - time in seconds at which the segment ends.
15. seg_type - state of the call (Begin/End/Intermediate).
16. outcome - cause of call termination (Handled/Transferred/Abandoned/..).
17. seg_parties - type of resource that answered the call (Agent/Supervisor/Conference/..).
18. wait_time – delay time plus queue time.
19. queue_time – queue time.
20. preservice_wait – ring time and call_type time.
21. service_time - talk time and hold time.
22. hold_time - hold time.
23. party_answered - resource/code number that answered the call; for example, if the number is greater than 10000, then an agent answered the call.

7.3 The queue table (relevant only for USBank)

Note that if a call is interqueued, then a segment will appear for each node at which it is queued.

1. call_id - universal identifier associated with the entire call.
2. cust_subcall - sequence number of service that a caller receive during his call.
3. record_id - ID number assigned to the record, this is created uniquely for all the segments of particular day.

4. node- identifier of the site where the call is being queued
5. NIQ - location and/or result of call transaction (2- processed at node which is “local” i.e. the original node, 3- processed remotely, 4- processed at the node which is not “local”, 5- picked up somewhere else).
6. service - type of service received by the caller.
7. queue_entry – time in seconds the caller enters the queue.
8. queue_exit - time in seconds the caller exits the queue.
9. wait_time – delay time and queue time.
10. queue_time - amount of time a caller spent listening to music or silence while waiting to speak to an agent (wait step time).
11. outcome - cause of call termination (Handled/Transferred/Abandoned/..).
12. niq_delay - time in seconds a customer spent at the local node till call was placed at other node/nodes.

7.4 The server sub-calls table

The table contains the extra segments calls that do ***not*** appear in the customer sub-calls table.

1. call_id - universal identifier associated with the entire call.
2. cust_subcall - sequence number of service that a caller receive during his call.
3. server_subcall - sequence number of server that handled the call.
4. record_id - ID number assigned to the record, this is created for the all segments of particular day.
5. agent - agent extension number that answers or originates the call segment.
6. party_type - segment types where agent participates (1 – agent answers the call segment, 2 – agent originates the call segment).
7. agent_group - agent group number to which the agent belongs.
8. orig_group – agent group or trunk group number to which the call segment destination belongs, depend on party type.
9. dest_group – agent group or trunk group number to which the call segment originator belongs, depend on party type.
10. node - identifier of the site where the call is presents
11. service_group - service group that handled the call.
12. service - type of service received by the caller.
13. start_time - date/time at which the segment is started.
14. end_time - date/time at which the segment is ended.
15. segment_start - time in seconds at which the segment is started.
16. segment_end - time in seconds at which the segment is ended.
17. call_type - type of call transaction (Incoming/Internal/Outgoing call) as determined by first segment of the call.
18. seg_type - state of the call (Begin/End/Interqueue/Transfer/Outgoing/..).
19. outcome - cause of call termination (Handled/Transferred/Abandoned/..).
20. seg_parties - type of resource answered the call (Agent/Supervisor/Conference/..).
21. wait_time - delay time and queue time.
22. preservice_wait - ring time and call_type time.
23. service_time – talk time and hold time.
24. party_answered - resource/code number that answered the call; if the number is greater than 10000, then an agent answered the call.

25. business_line – boolean digit assigned to the number of services received from an agent (1 - a caller received at least one service, 0 - otherwise).

7.5 The agents' shifts table

1. agent - agent extension number.
2. node - identifier of the site where the call is presents.
3. primary_service - service the agent skilled to provide.
4. shift_id – the ordinal number of shift.
5. shift_start - time in seconds at which the shift is started.
6. shift_end - time in seconds at which the shift is ended.
7. start_time - date/time at which the shift is started.
8. end_time - date/time at which the shift is ended.
9. duration – amount of time an agent operates a given shift.
10. interv – amount of time between a present shift start and the previous shift end.

7.6 The agent profile table

1. agent - agent extension number.
2. node - identifier of the site where the call is presents.
3. primary_service - service the agent skilled to provide.
4. signon – time in seconds at which the agent starts operating in a particular day, start of first shift if there are more than one.
5. signoff - time in seconds at which the agent ends operating in a particular day, end of last shift if there are more than one.
6. start_time - date/time at which the agent starts first shift.
7. end_time - date/time at which the agent ends last shift.
8. dur – duration between sign on and signoff.
9. dur_signon – duration agent was signed on during all shifts.
10. work_time – part of dur_signon, duration agent answered or originated the call.
11. dur_idle – part of dur_signon, duration agent was on idle states.
12. dur_avail – part of dur_signon, duration agent was on available state.
13. dur_break – part of dur_signon, duration agent was on break states.
14. dur_err – duration agent was between shifts, if there are more than one.
15. dur_inc – duration of incoming calls.
16. dur_out – duration of outgoing calls.
17. dur_ins – duration of inside calls.
18. num_inc – number of incoming calls taken.
19. num_out – number of outgoing calls.
20. num_ins – number of inside calls taken.
21. dur_hold – duration of hold time, includes all calls.
22. dur_wrapup_inc – wrapup time for incoming calls.
23. dur_wrapup_out – wrapup time for outgoing calls.
24. serv_hang0 – percent of incoming to business line calls terminated by agent lasting 0 second.
25. serv_hang1 – percent of incoming to business line calls terminated by agent lasting 1 second.
26. serv_hang2 – percent of incoming to business line calls terminated by agent lasting 2 second.

27. serv_hang3 – percent of incoming to business line calls terminated by agent lasting 3 second.
28. serv_hang4 – percent of incoming to business line calls terminated by agent lasting 4 second.
29. serv_hangLT5 – percent of incoming to business line calls terminated by agent lasting 0-5 seconds.
30. serv_hang5to19 – percent of incoming to business line calls terminated by agent lasting 6-19 seconds.
31. agent_term – number of incoming to business line calls terminated by agent.
32. cust_term – number of incoming to business line calls terminated by customer.
33. transfer_term – number of incoming to business line calls terminated by transfer.
34. undefined_term – number of incoming to business line calls with undefined termination reason.
35. n_blcalls – number of business calls taken, for incoming calls only.
36. n_nblcalls – number of non-business calls taken, for incoming calls only.
37. p_blcalls – percent of incoming calls taken of business line.
38. agent_group – agent group number to which the agent belongs.
39. consult_n_blcalls – number of calls where agent participate as a consultant.

7.7 The event details table *(relevant only for ILTelecom)*

1. agent – agent extension number.
2. node - identifier of the site where the agent is presents.
3. end_time - time in seconds at which the segment is ended.
4. event_type – type of event (e.g. sign-on, sign-off, idle or available) agent registers during his shift.
5. duration – amount of time agent performing an event specified in field event_type.

7.8 The agent events table

1. agent – agent extension number.
2. node - identifier of the site where the agent is situated.
3. primary_service - service the agent is skilled to provide.
4. start_time - time in seconds at which the segment is started.
5. end_time – time in seconds at which the segment is ended.
6. event_id – event codes for idle states (40-49), breaks (60-62), available state (50), sign-on states (20-21), sign-off states (30-31), agent originated (2) or agent answered (1) call segment.
7. record_id – ID number assigned to the record, this is created for all the segments of a particular day.
8. business_line – associated call received at least one service – 1, or otherwise - 0.
9. service – type of service received by the caller.
10. duration - amount of time agent performing an event specified in field event_id.

7.9 The agent records table

1. call_id - universal identifier associated with the entire call.
2. node - identifier of the site where the agent is present.
3. primary_service – service the agent is skilled to provide.

4. cust_subcall – sequence number of service that a caller received during his call.
5. server_subcall - sequence number of server that handled the call.
6. customer_type – type of a phone number registered by a system (1- cellular number, 3 – land-line number, 4 – others).
7. customer_id – customer ID generated from his phone number.
8. record_id – ID number assigned to the record, this is created for all the segments of particular day.
9. agent – agent extension number.
10. party_type – segment types where agent participates (1 – agent answers the call segment, 2 – agent originates the call segment, 3 – agent consults on the call segment).
11. service_group – service group that handled the call.
12. service – type of service received by the caller.
13. start_time - time in seconds at which the segment is started.
14. end_time – time in seconds at which the segment is ended.
15. service_start - time in seconds at which the segment is started.
16. service_end – time in seconds at which the segment is ended.
17. work_time – service time of agent.
18. wait_time – amount of time agent spent on delay or queue time, for agent originated call or when agent consults another agent which is online with the customer or third agent, otherwise it is 0.
19. ring_time – the length of time required for the agent to pick up the call.
20. ctype_time - amount of time an agent spent listening to a call type announcement prior to being connected to this call.
21. talk_time – duration that the agent spent connected to the caller.
22. hold_time – amount of time a caller spent on hold on an agent's teleset.
23. wrapup_time – amount of time an agent spent in a wrap-up state after the completion of the call.
24. app_code – application number (see AppMap table) the call was handled by.
25. call_type – type of call transaction (Incoming/Internal/Outgoing call) as determined by first segment of the call.
26. seg_parties – type of resource answering the call (Primary Agent/Not Primary Agent)
27. outcome – cause of call termination (Handled/Transferred).
28. seg_type – state of the call (Begin/End/Interqueue/Transfer/Outgoing/..)
29. business_line – associated call received at least one service – 1, or otherwise - 0.
30. orig_group – agent group or trunk group number to which the call segment destination belongs, depends on party type.
31. dest_group – agent group or trunk group number to which the call segment originator belongs, depends on party type.
32. agent_group – agent group number to which the agent belongs.
33. other_lines_time – amount of time agent took part on another line in parallel to given segment line
34. line_type – type of segment line: 0 – regular (agent answers or originates the call), 2 – consultant (agent consults on the call), or 1 – merged (2 segments associated with particular call merged: customer –agent A and agent A – agent B to customer – agent B).

8 Statistical Summary Tables and Interface

Many descriptive and analytical tasks can be performed based on prepared *Summary Tables* that are derived from the basic and detailed ACCESS tables described above. A set of these summary tables are provided with the database, as well as a tool (interface) which facilitates carrying out these tasks.

The STATCCA interface also allows the (more advanced) user to create new Summary Tables which will then be available for each day of each month.

The basic STATCCA user interface itself is described in Appendix 3 below, and extra advanced uses are described in Volumes 3.2 and 3.3.

9 Appendix 1 – The Call Center of a US Bank

The source of this example data base is a large Call Center of a US bank. It has sites in New York, Pennsylvania, Rhode Island, and Massachusetts. The Call Center processes up to 300,000 calls a day, routes calls according to agent skills, and simultaneously queues calls across multiple sites. The Call Center provides the "correct" initial routing decision about 90 percent of the time and for the rest of the calls the center relies on a Network InterQueue. With the Network InterQueue, the Call Center routes the calls across a multi-node network based on business rules. The center provides several types of services: the most common of which are Retail, Premier, Business, Consumer Loans, Online Banking and Telesales.

The Call Center consists of about 900-1200 agent positions on weekdays and 200-500 agent positions on weekends, unevenly distributed through the different nodes. These agents are service agents that represent the members of the primary agent group or super group. Working hours are 24 hours a day, 7 days a week. The data are compiled on a daily basis, from March 26, 2001 to April 24, 2003. There are 200,000–270,000 calls per weekday, 120,000-140,000 per Saturday and 60,000–100,000 calls per Sunday (based on April, 2001).

9.1 Data description

The database consists of ACCESS tables of daily data for the period from March 26, 2001 to October 26, 2003. A single call can consist of more than one segment; therefore it can occupy more than one record in the data table. A call segment record is constructed for each leg of the call. This record provides detailed information on the interaction between the customer and VRU, announcement, or agent; between two agents; and between the VRU and agent.

The call can consist of several customer sub-calls from the customer's perspective and several server sub-calls from server's perspective. Each customer sub-call includes the call segment records involving the customer interaction with a particular party. The second and subsequent customer sub-calls are: agent-initiated calls that represent customer interaction with the VRU; an Announcement; or service by another agent. The second and subsequent server sub-calls are the agent-initiated calls that occupy a new line in the system and continue in parallel or after the customer sub-call. For instance, if a customer dials into the Call Center and reaches the VRU, then s/he transfers to an agent, there would be a first customer and server sub-call; if thereafter the customer asks to speak with another agent and Agent A succeeds to connect the customer to Agent B at the second attempt, there would be two additional server sub-calls and a second customer sub-call.

As discussed earlier, the Call Center enables one to operate different sites or *nodes* from one real-time geographical location. Hence the definition of the nodes is technical. It could be that agents who are working in two nodes are located in the same place. Moreover, agents who are working on the same node could be geographically located in different places.

All the nodes use the Call Center to route calls and to integrate agent desktops with customer databases. Pre-call routing provided by the Call Center network makes initial routing decisions, based on staffing at each site, and the Network InterQueue manages cross-node transfers. There are three situations that deal with tracking interqueued customer calls: either the call is served at the local node, namely the node where it originates, or served at one of the alternative nodes that can provide the desired service, or the call is abandoned. In these situations the call includes segments informing about the node where the call was served or abandoned, and the node/nodes from which the call is disconnected. Figure 2.2 demonstrates these three situations.

For each month a Monthly Records table was produced. It includes information per day about missing days, the number of duplicate records (segments), the number of records with a UCID (a unique identifier for the call) that appears to be placed in the wrong day, the number of records that do not have any beginning of the call, the number of records with absent segments, the number of records with a new UCID given to the records with a different old UCID but with the identical Track (does not remain the same for segments that do not include the customer), the number of duplicated records after a new UCID. All these problematic calls were placed, separately from the intact calls, in a garbage Access file. The summary of the problematic calls over the period from March 26, 2001 to April 24, 2003 are shown in the following table:

Month	missing days	duplicates	record_errors	local_missing	gaps	newUCID	duplicates_new UCID
March, 2001	25	4	2	0	0	0	0
April, 2001	0	1621	1454230	9	40	24151	43411
May, 2001	1	44337	224139	73	128	511	564
June, 2001	0	61118	16884	1038	0	1987	1987
July, 2001	0	23	1	4	19	0	7
August, 2001	0	7	419712	0	0	0	355
September, 2001	0	221912	659572	1015	302	131160	131930
October, 2001	0	8	40641	418	203	0	248
November, 2001	0	31358	221407	3	5	671	698
December, 2001	0	92949	405871	74	31	1728	1846
January, 2002	0	2	263263	11	43	0	46
February, 2002	0	8805	3	39	37	25	39
March, 2002	0	14708	679342	141	22	94	14762
April, 2002	0	675	108998	11	54	19892	20288
May, 2002	0	240191	593134	1	13	2439	2484
June, 2002	0	7	0	2	1	0	22
July, 2002	0	7	1865103	268	61	0	1267
August, 2002	0	6	9	0	4	0	101
September, 2002	3	1320	307524	3493	26	21	2475
October, 2002	0	4	3	6420	0	0	0
November, 2002	2	39164	160977	2454	2808	528	9124
December, 2002	0	0	0	0	14	0	3
January, 2003	1	43	6	104	44	0	95

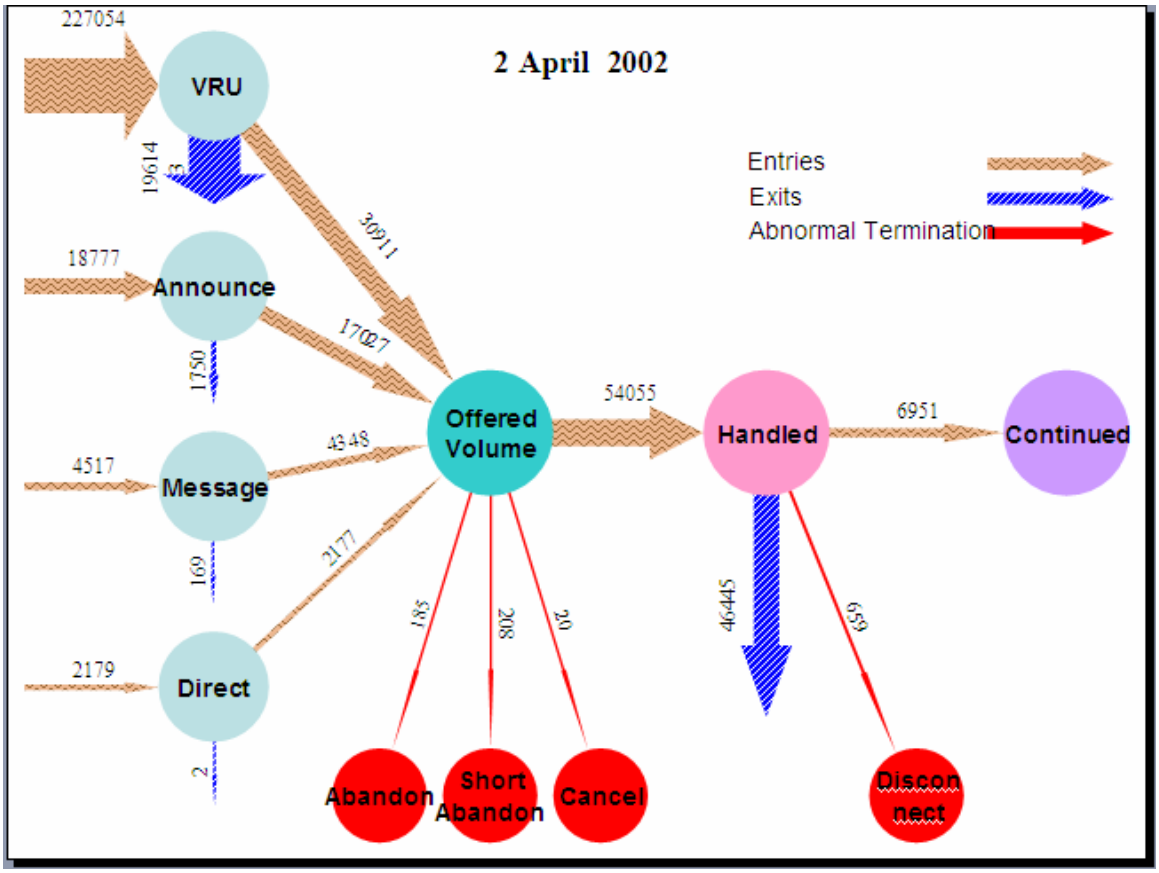
Month	missing days	duplicates	record_errors	local_missing	gaps	newUCID	duplicates_new UCID
February, 2003	0	193	126853	47	89	0	1473
March, 2003	0	175	6	0	7	0	3
April, 2003	10	50	35836	2	25	0	2688
Total	42	758687	7583516	15627	3976	183207	235916

In the second step the AppMap Access tables are produced and include description of application numbers – based on the APP_# field in the original *txt*-files that were supplied separately. The specific application numbers are used to identify different agent groups (services). The meaning of the application numbers is different for different switch nodes and periods of time; therefore AppMap-tables are produced accordingly for each switch node.

9.2 A typical day in April 2002

We have chosen a typical day – Tuesday, April 2, 2002 – since this day is with virtually no problematic calls. There are 261,143 calls. The following figure describes the process-flow of calls. There are 4 significant entry points to the system: through VRU ~ 87%, Announcement ~ 7%, Message ~ 2% and Direct group (callers that directly connect to an agent) ~ 1%; and there is an Others group ~ 3%, which includes the calls with undecipherable application numbers. About 79% of the calls exit from the system through the VRU, Announcement, Message and Others groups; while another 21% of callers entering these groups seek service by an agent. All callers that seek service by an agent, about 21% of incoming calls, form the Offered Volume.

At this stage, of the Offered Volume, agents handle 99% of the calls and 1% are abandoned. The first served callers include those that will request other services by an agent (about 13% of the handled calls); and 87% of callers terminate the system after receiving service by a single agent.



The following table summarizes the incoming calls according to type of services the call requests. The Retail, EBO and Subanco services are combined into one field.

Telephone Banking Performance Report by Business Line on Tuesday, April 2, 2002

Entries/Exits of system (% out of Total calls):

	Total	**Retail EBO Subanco**	Premier	Business	Platinum	Consumer Loans	Online Banking	Telesales
calls Total	261143	225554	5883	12996	268	4415	1943	3229
VRU	227054 86.95%	212638 94.27%	3815 64.85%	9910 76.25%		691 15.65%		
Announcement	18777 7.19%	11681 5.18%	1988 33.79%	25 0.19%	194 72.39%	2774 62.83%	1290 66.39%	825 25.55%
Message	4517 1.73%	25 0.01%	52 0.88%	2577 19.83%		89 2.02%		1774 54.94%
Direct	2179 0.83%	579 0.26%	25 0.42%	68 0.52%		573 12.98%	304 15.65%	630 19.51%
From Other Services	1761 0.67%	631 0.28%	3 0.05%	416 3.20%	74 27.61%	288 6.52%	349 17.96	
Other	6855 2.62%							
VRU Exit	186109 71.27%	173083 76.74%	3386 57.56%	9109 70.09%		529 11.98%		
Announcement Exit	5344 2.05%	4333 1.92%	451 7.67%	66 0.51%	2 0.75%	321 7.27%	100 5.15%	70 2.17%
Message Exit	351 0.13%	81 0.04%	81 1.38%	160 1.23%		1 0.02%		28 0.87%
Other Exit	13110 5.02%	6155 2.73%	2 0.03%	70 0.54%		7 0.16%	1 0.05%	28 0.87%
Other Services	1761 0.67%	1422 0.63%	78 1.33%	229 1.76%		27 0.61%		
Offered Volume	54468 20.86%	40480 17.95%	1885 32.04%	3362 25.87%	266 99.25%	3530 79.95%	1842 94.80%	3103 96.1%

Handled/Unhandled calls (% out of Offered Volume):

	Total	Retail EBO Subanco	Premier	Business	Platinum	Consumer Loans	Online Banking	Telesales
Handled	54055 99.24%	40220 99.36%	1873 99.36%	3321 98.78%	263 98.87%	3500 99.15%	1826 99.13%	3052 98.36%
Short Abandon	208 0.38%	129 0.32%	5 0.27%	36 1.07%	3 1.13%	10 0.28%	5 0.27%	20 0.64%
Abandon	185 0.34%	119 0.29%	4 0.21%	5 0.15%		16 0.45%	11 0.6%	30 0.97%
Other Unhandled	20 0.04%	12 0.03%	3 0.16%			4 0.11%		1 0.03%
Offered Volume	54468	40480	1885	3362	266	3530	1842	3103

	Total	Retail	Premier	Business	Platinum	Consumer Loans	Online Banking	EBO	Telesales	Subanco
Abandon Rate	0.8	0.6	0.6	1.2	1.1	0.8	0.9	0.2	1.6	2.7
Average Waiting Time for All	3.2	3	3.9	1.6	2.3	3.1	2.5	7.5	6.1	23.1
Average Waiting Time for Waiting	17.4	18.4	5	16	13.4	11.7	34	15.2	46.9	87.6
Percent of Nonwaiting	84.5	86.9	25.4	94.2	87.2	77.5	94.1	52.6	87.3	74.3
Average Service Time	235.3	214.9	271.4	209.2	213.5	246.1	362.9	460.8	374.1	352.6

10 Appendix 2 – Dictionary tables

The fields, their codes and descriptions, are divided into those that are common (or expected to be) to all data sources; and those specific to a given data source. The two data sources included here are the USBank and an Israeli Telecom company (ILTelecom).

10.1 Common Tables

Call types field		
code	**name**	**short_name**
1	Incoming call	Incoming
4	Internal call	Internal
5	Outgoing call	Outgoing
6	Message key	Message
7	Missing segment	Missing

Service group field		
code	**name**	**short_name**
1	VRU	VRU
2	Business Line	BusinessLine
3	Announcement	Announcement
4	Message	Message
5	NonBusiness Line	NonBusinessLine
6	NonCC Service	NonCCService
8	Overnight Closed	Closed
9	Trunk	Trunk
10	Incoming NonBusiness	IncomingNonBusiness
11	Internal	Internal
12	Outgoing	Outgoing
15	Disconnected	Disconnected
99	Unknown	Unknown

Segment type field		
code	**name**	**short_name**
1	customer call start	cust_call_start
2	customer call start and end	cust_call_start_end
3	customer call end	cust_call_end
4	customer call middle segment	cust_call_middle
5	processed in another queue	process_elsewhere
6	outgoing	outgoing
7	transfer	transfer
8	external transfer	external_transfer
9	agent to agent	agent_to_agent
10	supervisor key pressed	supervisor_key
11	message key pressed	message_key
12	predictive message	predictive_message

Segment parties field		
code	**Name**	**short_name**
10	Trunk	Trunk
11	Trunk + Conference	Trunk_Conference
12	Trunk + Emergency	Trunk_Emergency
13	Trunk + Conference + Emergency	Trunk_Conference_Emergency
20	Agent	Agent
21	Agent + Conference	Agent_Conference
22	Agent + Emergency	Agent_Emergency
23	Agent + Conference + Emergency	Agent_Conference_Emergency
30	Announcement	Announcement
31	Announcement + Conference	Announcement_Conference
32	Announcement+ Emergency	Announcement_Emergency
33	Announcement + Conference + Emergency	Announcement_Conference_Emergency
40	Voice port	Voice
41	Voice port + Conference	Voice_Conference
42	Voice port + Emergency	Voice_Emergency
43	Voice port + Conference + Emergency	Voice_Conference_Emergency
50	Agent	Agent
51	Agent + Conference	Agent_Conference
52	Agent + Emergency	Agent_Emergency
53	Agent + Conference + Emergency	Agent_Conference_Emergency
80	Virtual trunk	Virtual
81	Virtual trunk + Conference	Virtual trunk_Conference
82	Virtual trunk + Emergency	Virtual trunk_Emergency
83	Virtual trunk + Conference+ Emergency	Virtual trunk_Conference_Emergency
90	Interflow trunk	Interflow_trunk
91	Interflow trunk + Conference	Interflow_Conference
92	Interflow trunk + Emergency	Interflow_Emergency
93	Interflow trunk + Conference + Emergency	Interflow_Conference_Emergency

Outcome field		
code	**name**	**short_name**
1	Caller Termination	CallerTermination
2	Agent Termination	AgentTermination
3	Undetermined Termination	UndeterminedTermination
4	Termination Error	TerminationError
11	Abandoned Short	AbandonedShort
12	Abandoned	Abandoned
13	Other Unhandled	OtherUnhandled
14	Unhandled Error	UnhandledError
20	Transfer	Transfer
21	Outgoing Transfer	OutgoingTransfer
22	Agent Transfer	AgentTransfer
23	Process Remotely	ProcessRemotely

Outcome field		
code	name	short_name
30	NIQ Disconnected	NIQDisconnected
40	Missing record	MissingRecord
50	Outbound call	OutboundCall

10.2 US Bank tables

Service field		
code	service	short_name
1	Retail	Retail
2	Premier	Premier
3	Business	Business
4	Platinum	Platinum
5	Consumer Loans	Consumer_Loans
6	Online Banking	Online_Banking
7	EBO	EBO
8	Telesales	Telesales
9	Subanco	Subanco
10	Case Quality	Case_Quality
11	Priority Service	Priority_Service
12	AST	AST
13	CCO	CCO
14	Summit	Summit
15	Quick&Reilly	Quick_Reilly
16	Mortgage	Mortgage
17	BPS	BPS

NIQ field		
code	name	short_name
2	Locally Handled	Locally_Handled
3	Process Remoted	Process_Remoted
4	Remotely Handled	Remotely_Handled
5	Handled at another node	Handled_another_node
6	Terminated due to an error	Terminated_Error

10.3 ILTelecom tables

Service field	
code	**name**
0	Total
1	Private
2	Private Platinum
3	Business
4	Platinum SH
5	Platinum SM
6	Financial
7	Payment
8	IB
9	Customer Relation SH
10	Judicial
11	Overseas
12	Marketing
13	Deliveries
14	Arabic I
15	Arabic
16	Russian
17	Engineering
18	Technical
19	Content Internet
20	Employees support
21	Common
22	Internet Applications

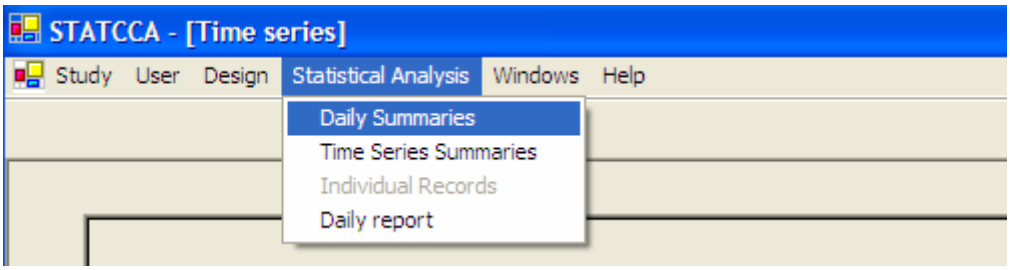
Event ID field		
code	**Name**	**short_name**
0	Total	Total
1	Long Break	Long_Break
2	Medium Break	Medium_Break
3	Short Break	Short_Break
4	Idle	Idle
5	Outgoing Call	Outgoing_Call
6	Available	Available
7	Incoming Call	Incoming_Call
20	Sign On	Signon
21	Internal Sign On	Internal_Signon
30	Signoff	Signoff
31	Internal Signoff	Internal_Signoff

11 Appendix 3 – DataMOCCA User Interface: the STATCCA tool

The STATCCA tool is a program designed to provide a friendly interface for processing and analysis of Call Center data. STATCCA primarily uses precompiled summary tables, due to the very large size of the complete databases (dozens of Gigabytes). Summaries are built on a monthly basis for each day of the month and for aggregated days (Mondays, Tuesdays,...,week days, all days). With the precompiled summaries, tables and charts are produced almost instantaneously with delays of up to only a few seconds.
There are three types of summary tables:

- **Daily Summaries** (using within-day data)
- **Time Series Summaries (**trajectories over days – currently within a month)
- **Daily reports**

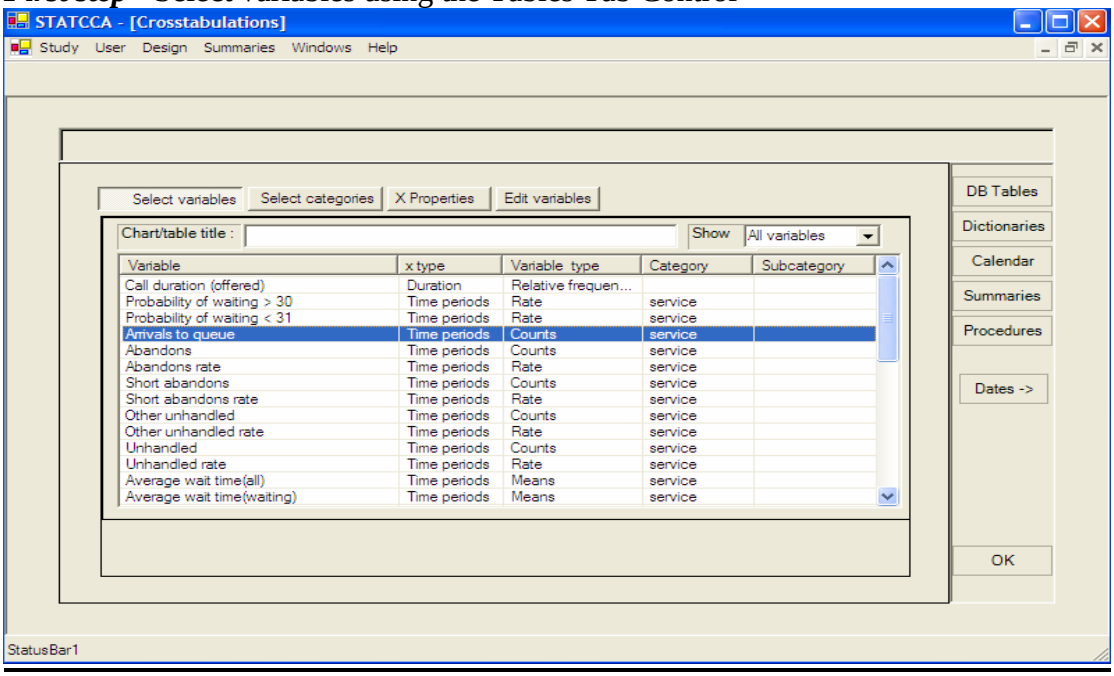
The selection of the type of summary table required is done with the menu item "Statistical Analysis".



Each of the three Statistical Analysis menu options each use two Tab Controls (two sets of pages with tabs to open them) for the definition of variables and selection of dates. The button “<- Tables” or “Dates->” switches between the two Tab Controls.

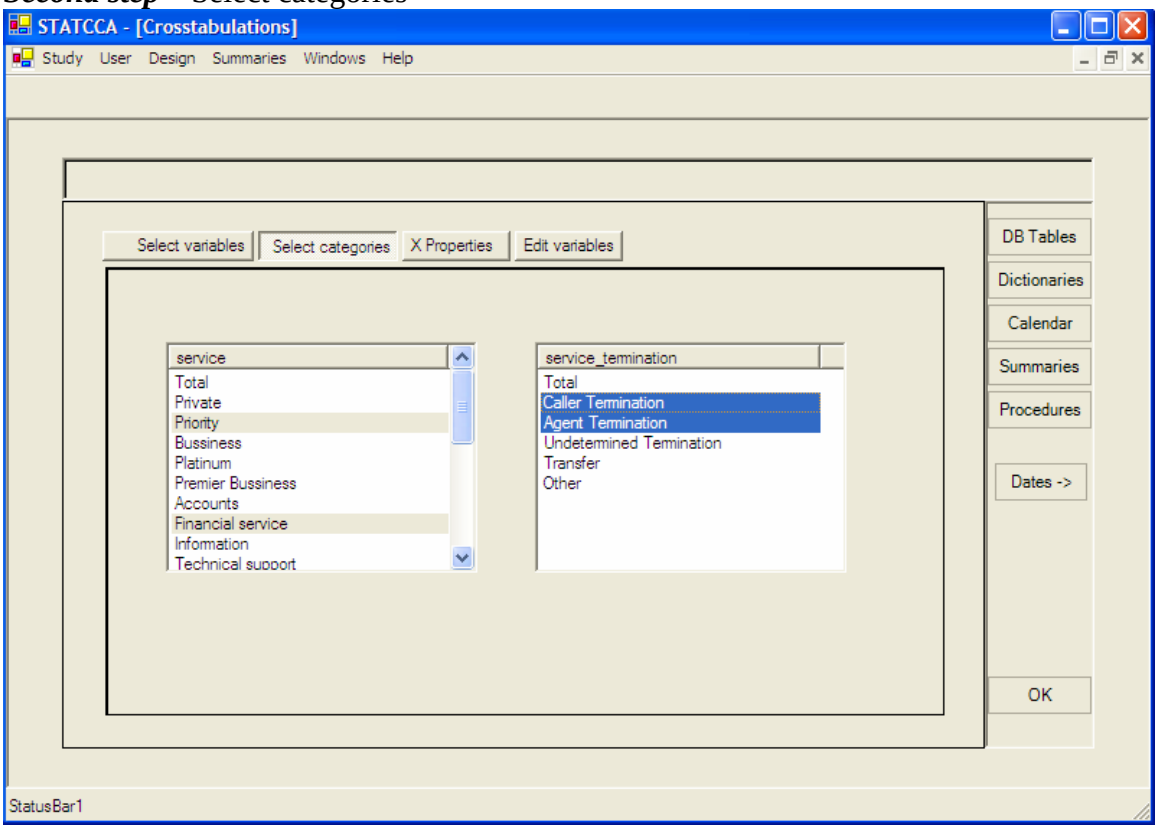
11.1 Variables definition

First step - Select variables using the Tables Tab Control



This page allows the user to select variables and also provides information about the type and dimension of variables.

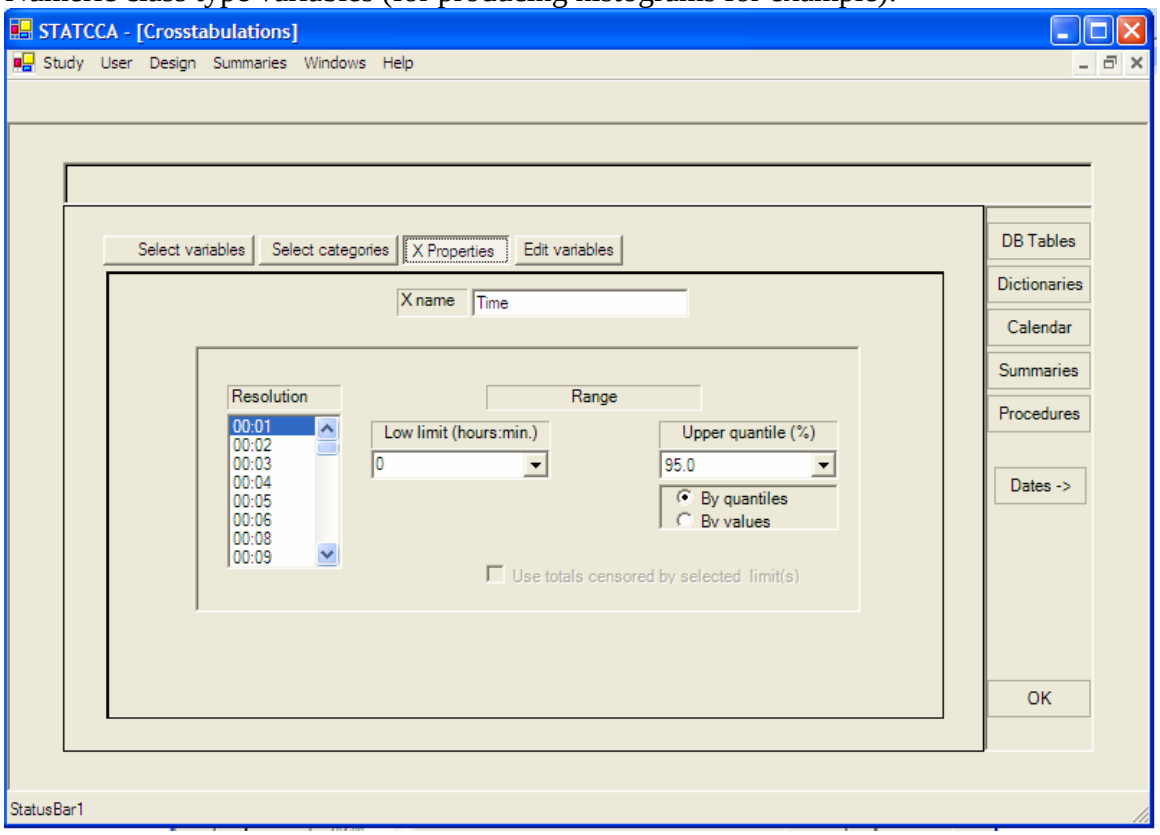
Second step – Select categories



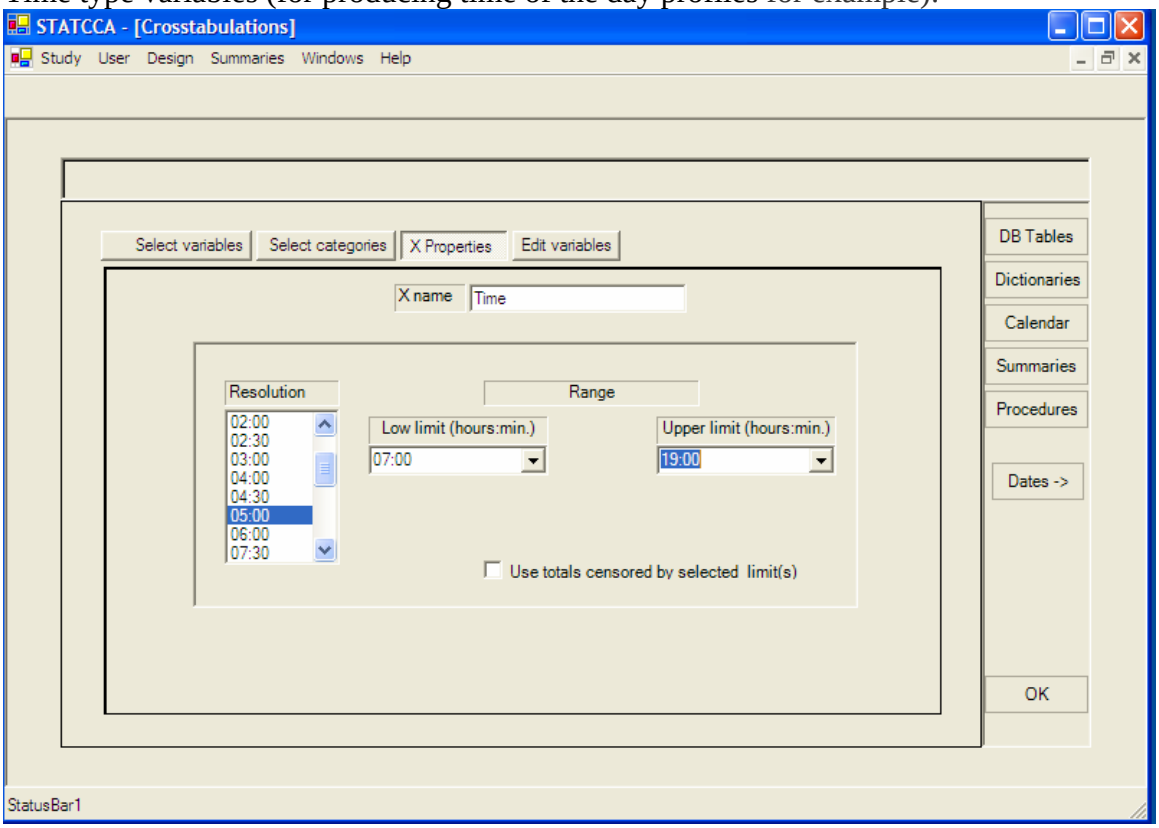
Variables could have up to 2 strata (categories and subcategories). Most variables have one stratum, which is the type of service, but there also are variables with two strata, as in the example above, where the user can choose the service type and the cause of service termination. The default option is an aggregation of all the categories (ie, Total is highlighted).

Third step – X properties
Not applicable for Time Series Summaries. The X value is the first dimension of data. There are two different 'X properties' pages depending on the X type of the variable: time type (time periods and instants) and numeric class type (duration, integer, float).

Numeric class type variables (for producing histograms for example):



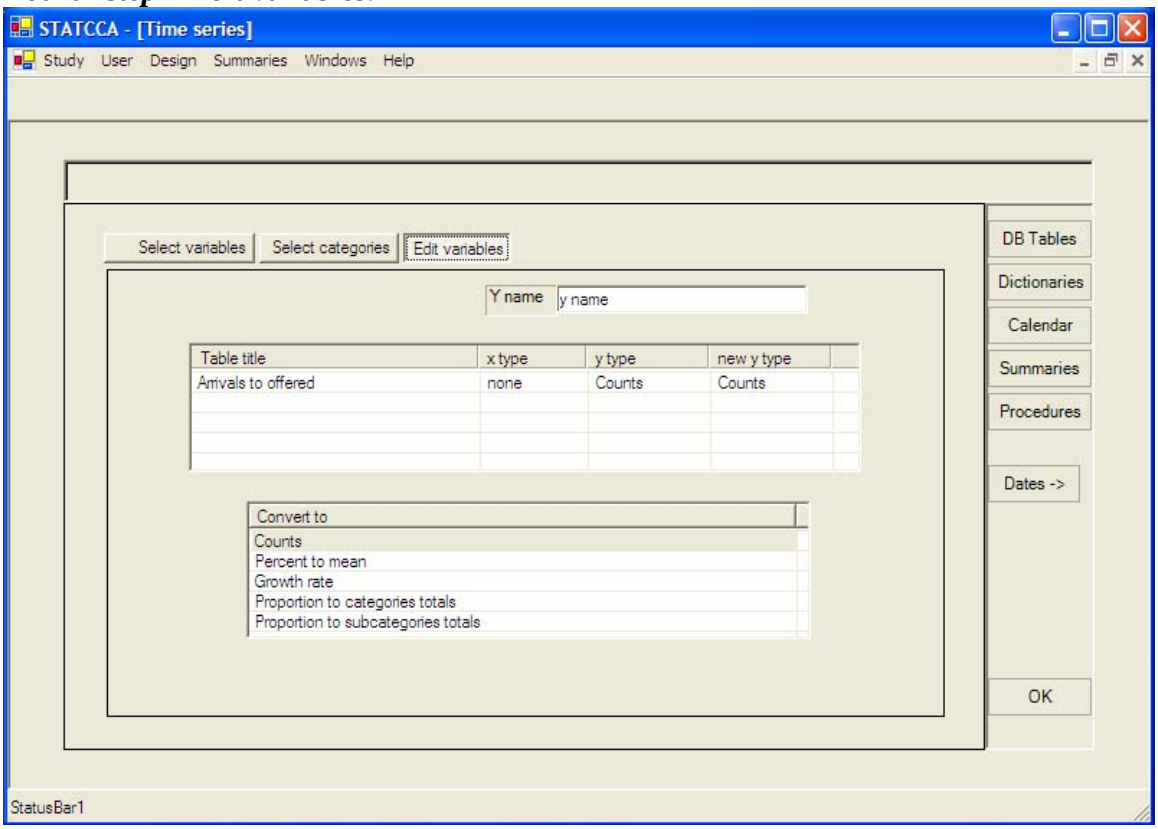
Time type variables (for producing time of the day profiles for example):



In both cases the user may select: *resolution* for aggregation of intervals. Original (finest) resolution available in the summary table is shown in the first row of the resolution window. The default resolution is highlighted.

Range of data is used to build tables and charts for time type variables by imposing lower and upper limits using the format: hours: minutes. In the example above the range excludes calls before 6:00 and after 19:00. For numeric class type variables the low limit is a value (for example, 2 seconds for waiting time, which has been used to exclude non-waiting customers), whereas the upper limit could be set as a quantile (because of highly asymmetric distributions, the default value is 0.95, which means that 5.0 percent of the largest observations are not plotted) or as a value.

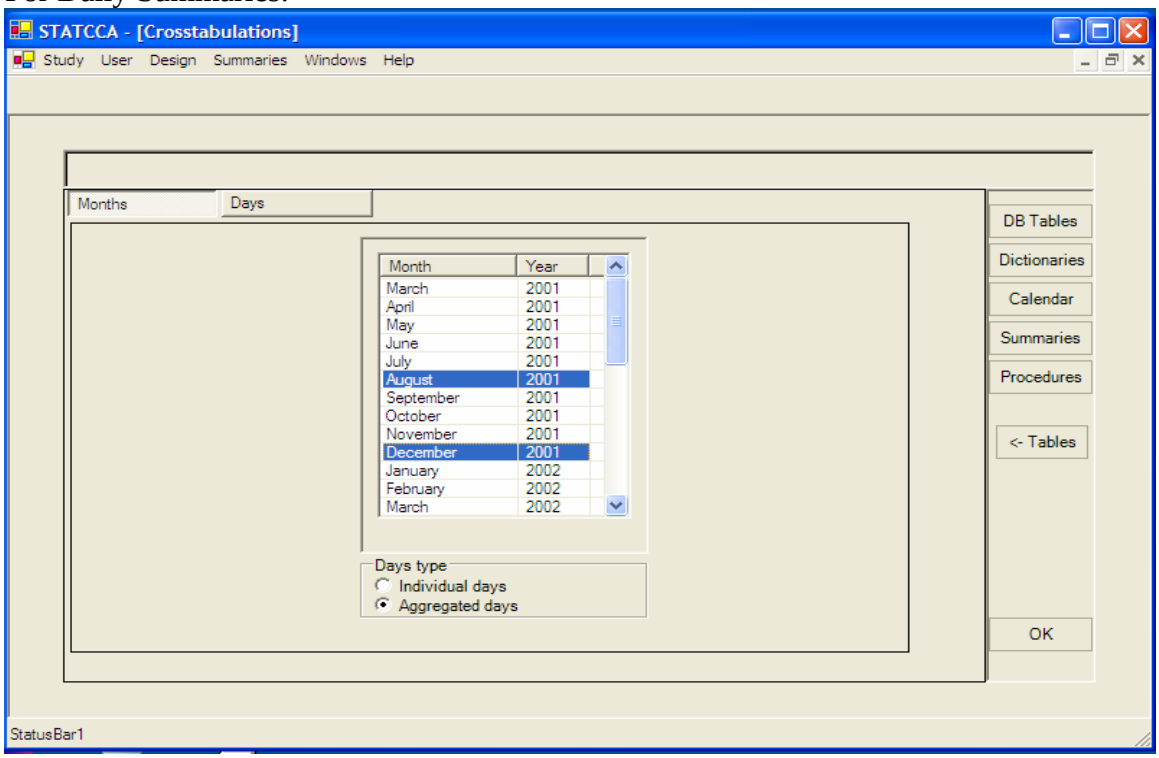
Fourth step – Edit variables.



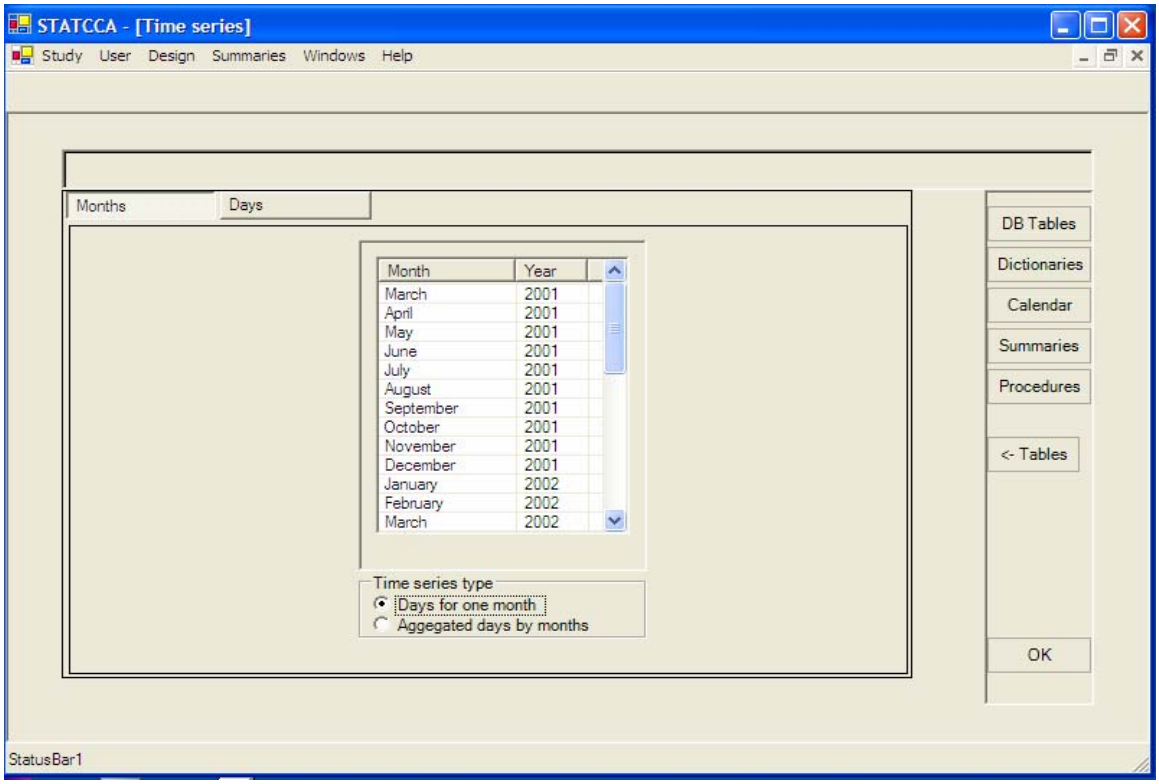
This page allows the user to select a transformation of variables for tables and charts. The list of available transformations necessarily depends on the variable type. The example above shows the transformations available for Time Series Summaries.

11.2 Dates selection

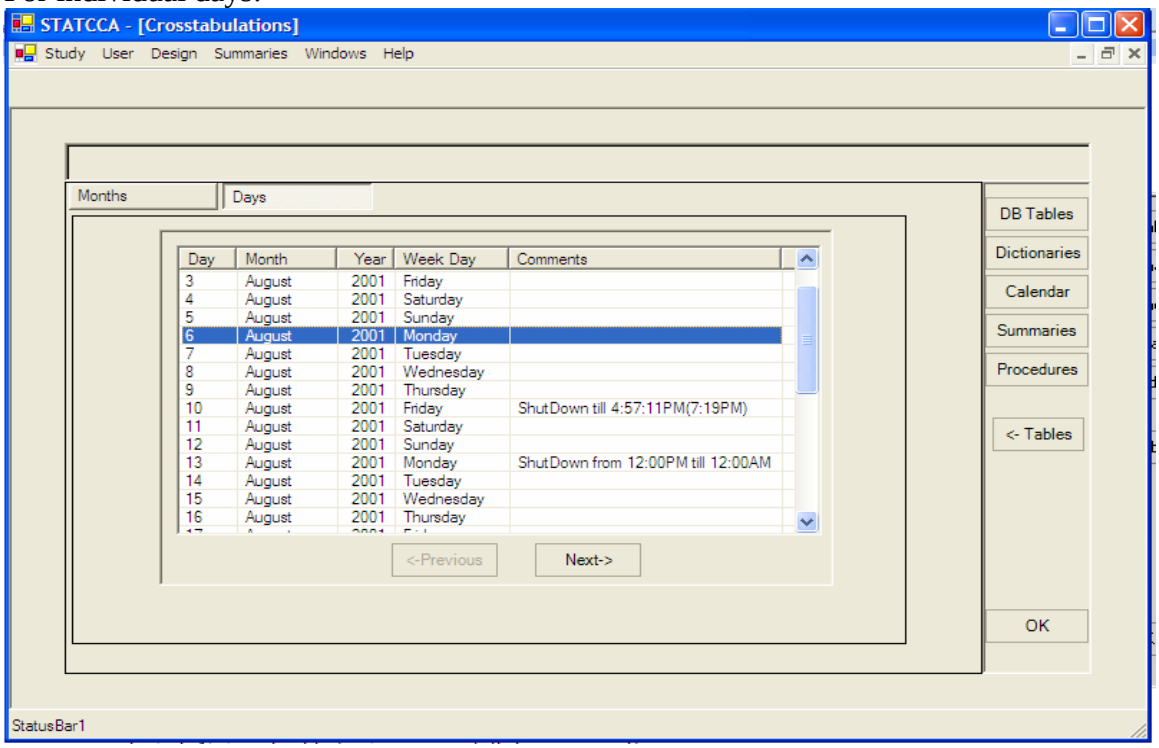
First step – Select month(s) and days type or time series type.
For Daily Summaries:



For Time Series Summaries:

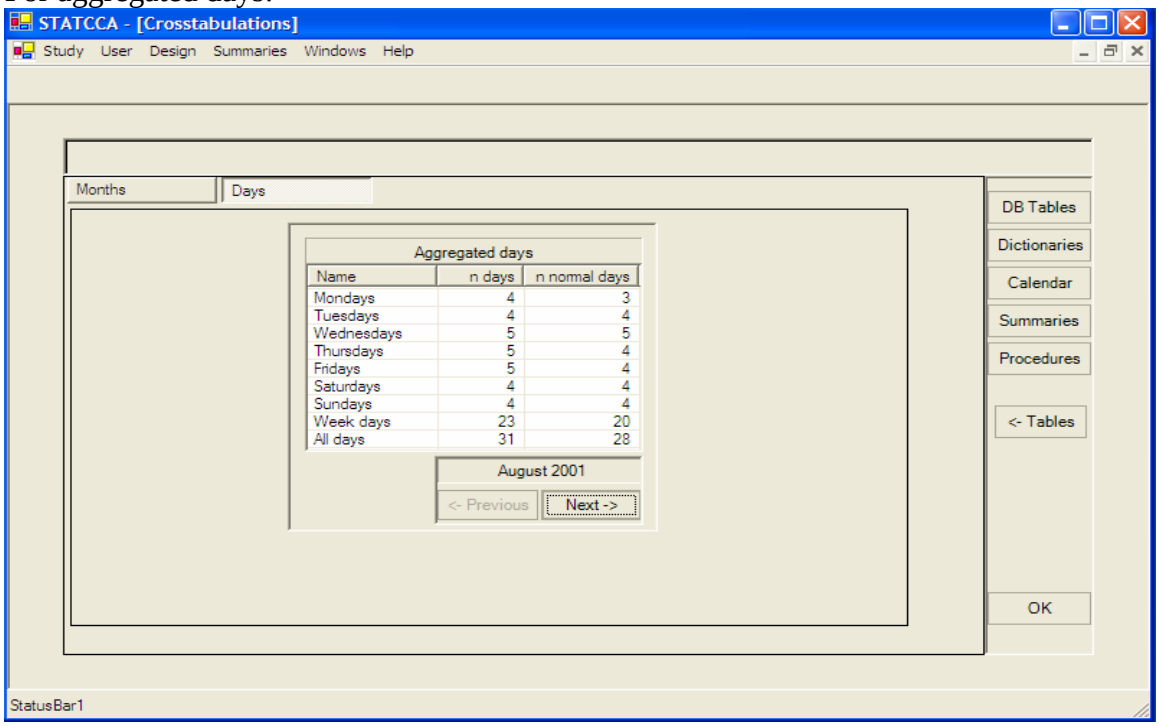


Second step – Select days.
For individual days:



The previous and next buttons are used to switch between months if more than one month is selected. Not applicable for Time Series Summaries (all days are used).

For aggregated days:



Columns "n days" and "n normal days" are provided as information. Abnormal days like holidays or days on which the system malfunctioned can be checked as on the previous page (for individual days under the comments column).

11.3 Other features

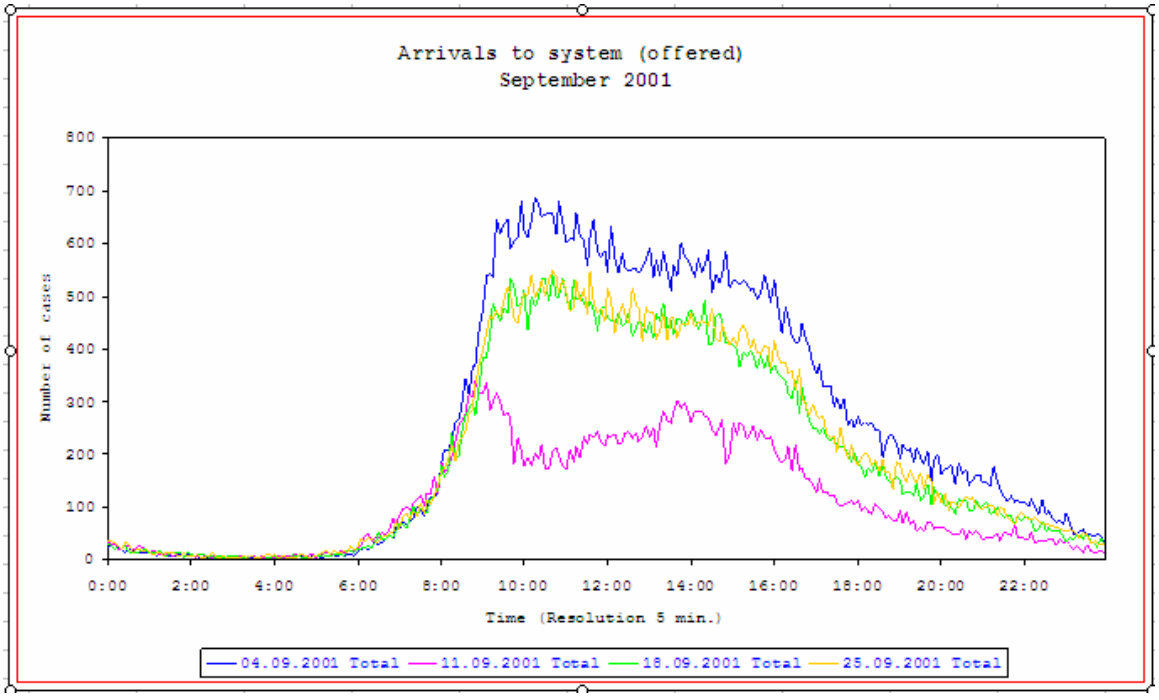
Users can create their own database as an annex to the DATAMOCCA database. STATCCA has a *design* interface allowing the user to design and produce new summary tables (variables from user-designed tables appear in the list of variables on the Select variables page) and design and create new database tables based on standard DATAMOCCA data tables (*dbprocedures* interface).

Buttons on the right upper side of each window are used to provide information on the database structure (description of tables and fields in the database, calendar identical to the dates selection tab, description of summary tables including the definition of variables, database dictionaries and user dbprocedures).

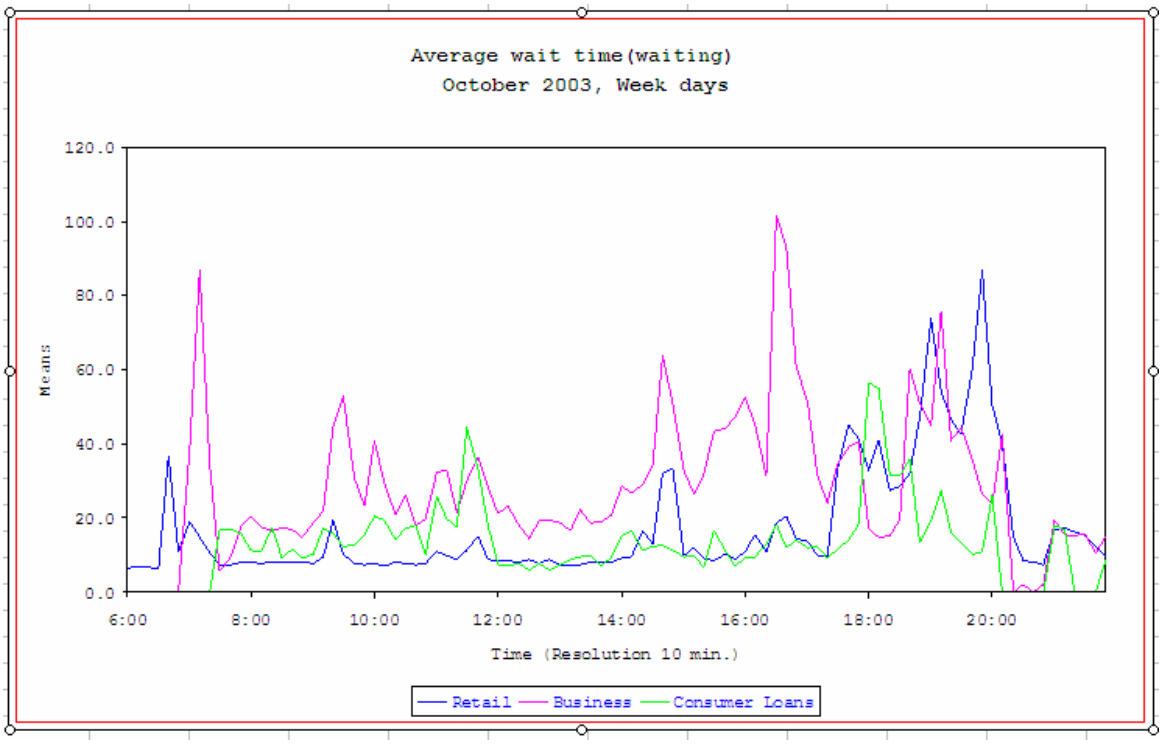
11.4 Samples of charts

Time periods

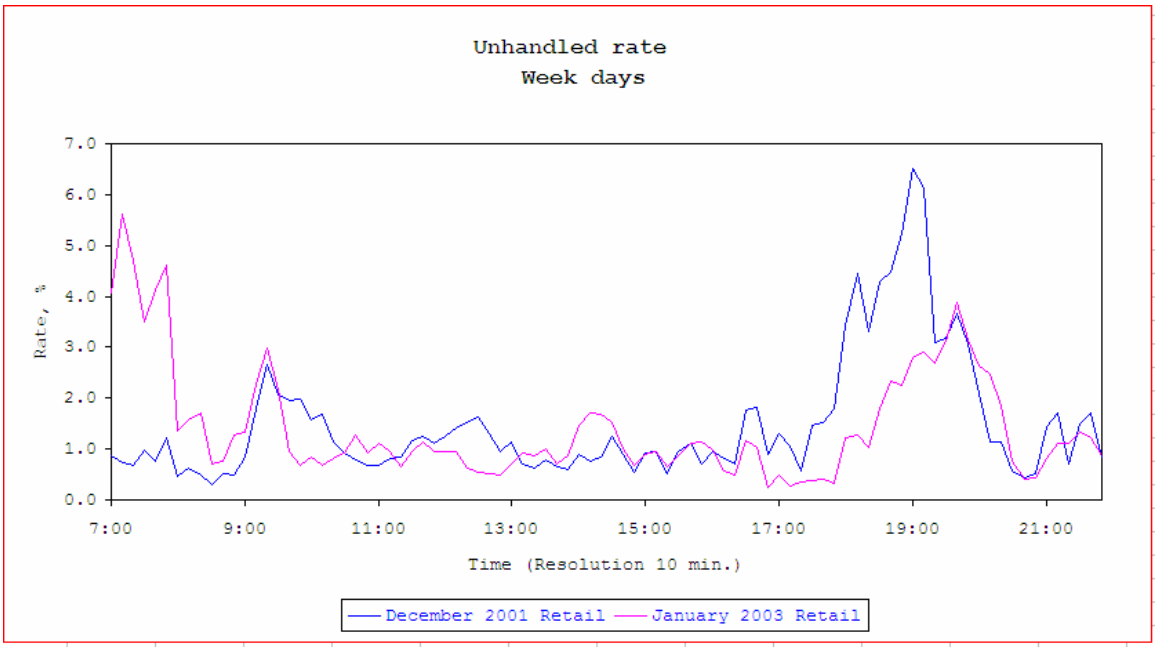
Counts



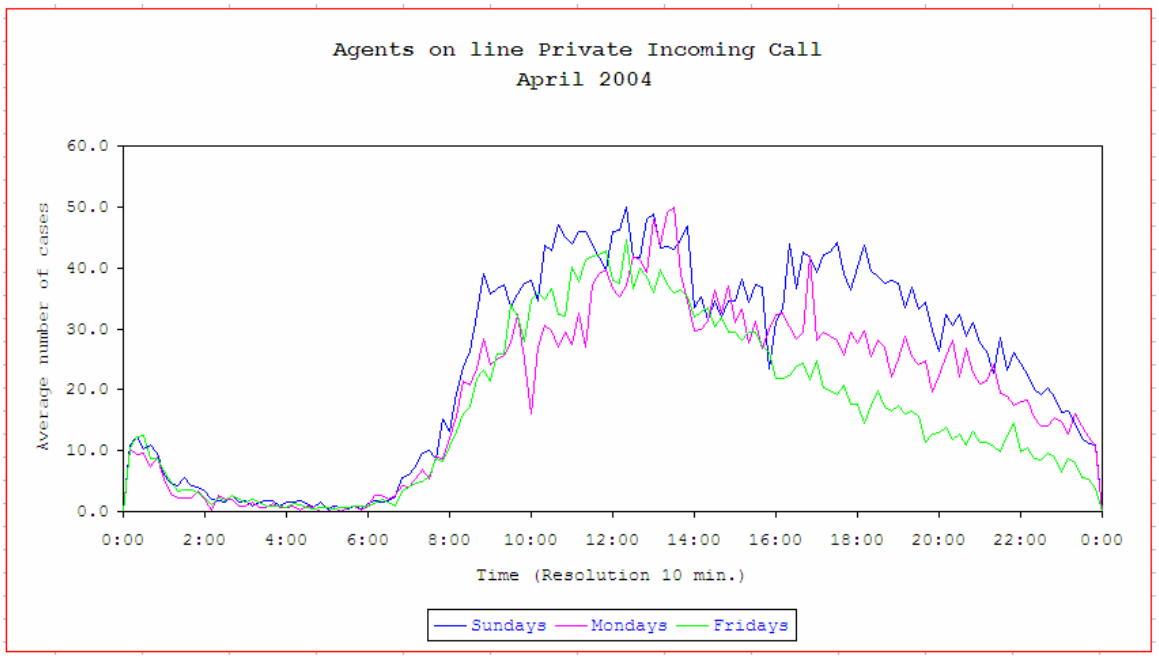
Means

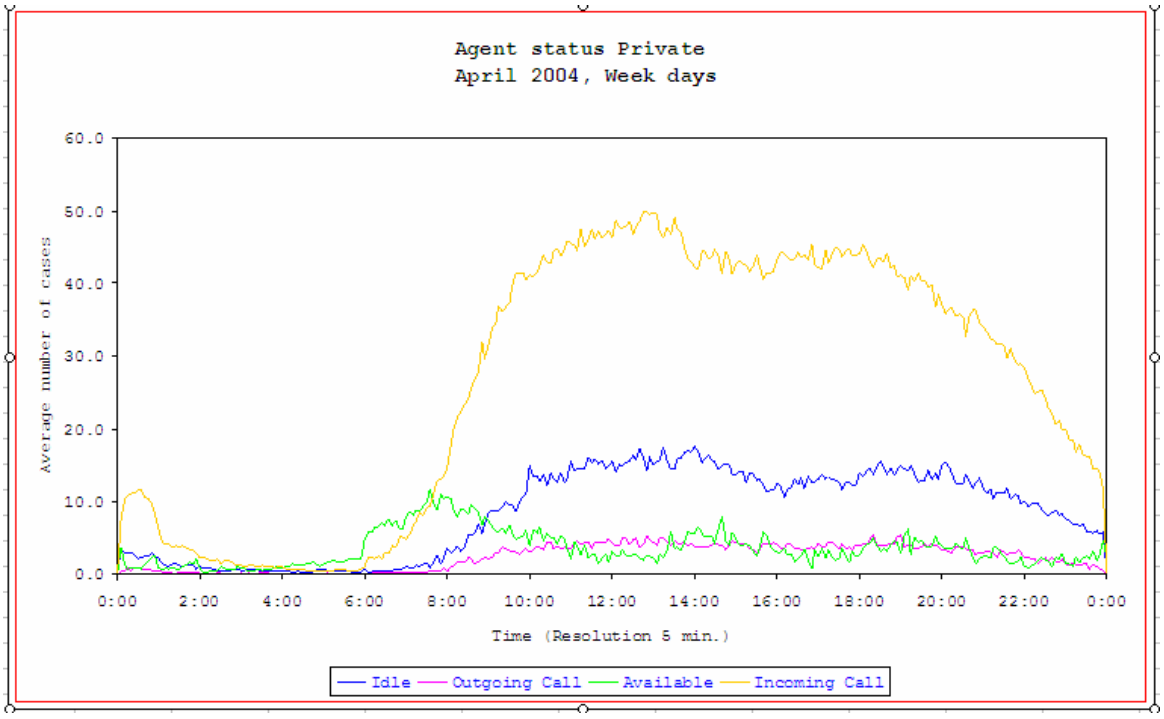

Average wait time(waiting)
October 2003, Week days
120.0
100.0
80.0
60.0
40.0
20.0
0.0
Means
6:00
8:00
10:00
12:00
14:00
16:00
18:00
20:00
Time (Resolution 10 min.)
Retail
Business
Consumer Loans

Rate


Unhandled rate
Week days
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
Rate, %
7:00
9:00
11:00
13:00
15:00
17:00
19:00
21:00
Time (Resolution 10 min.)
December 2001 Retail
January 2003 Retail

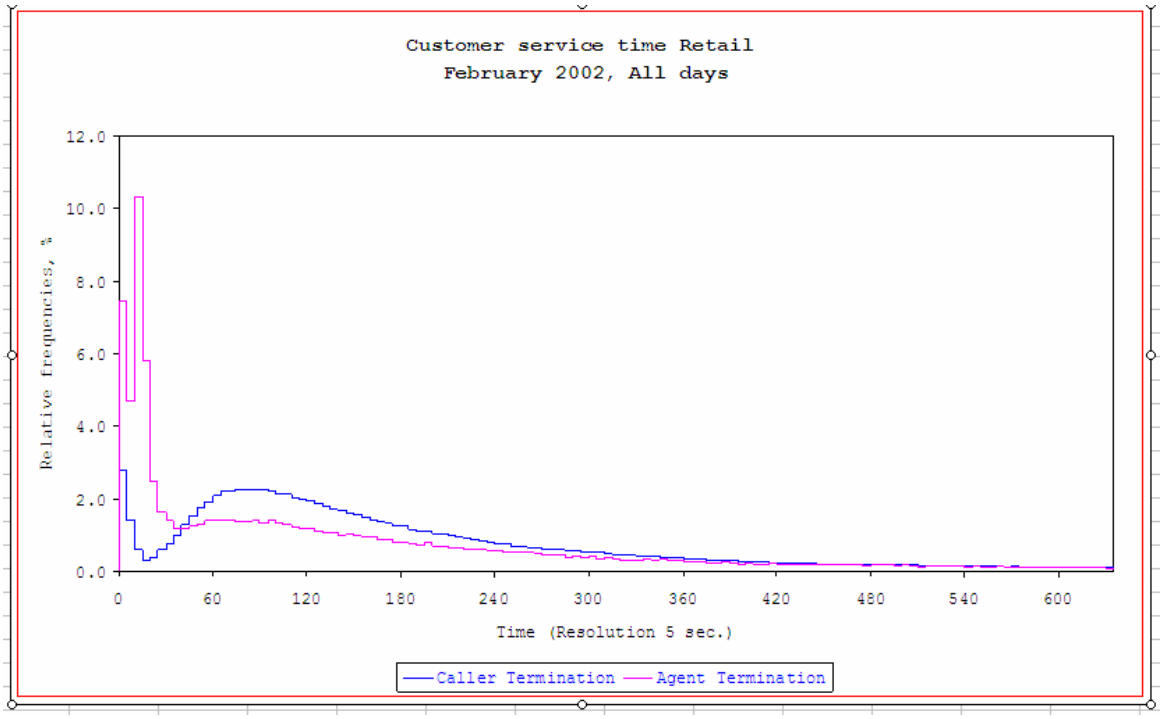
Instants

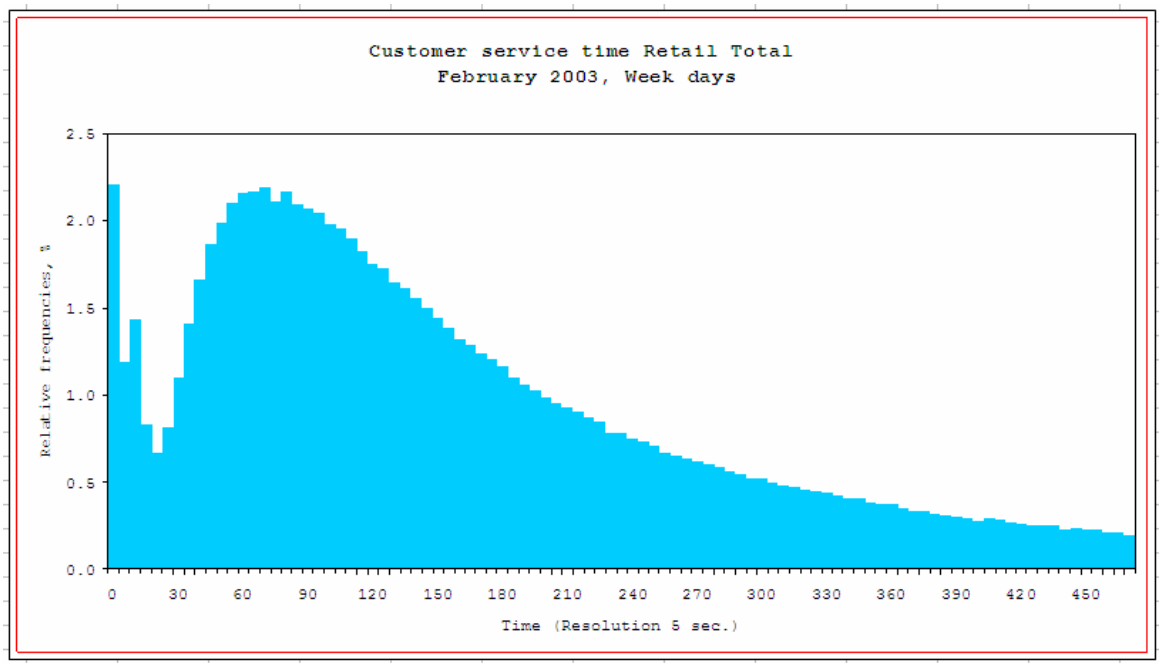

Agents on line Private Incoming Call
April 2004
Average number of cases
60.0
50.0
40.0
30.0
20.0
10.0
0.0
0:00
2:00
4:00
6:00
8:00
10:00
12:00
14:00
16:00
18:00
20:00
22:00
0:00
Time (Resolution 10 min.)
Sundays
Mondays
Fridays

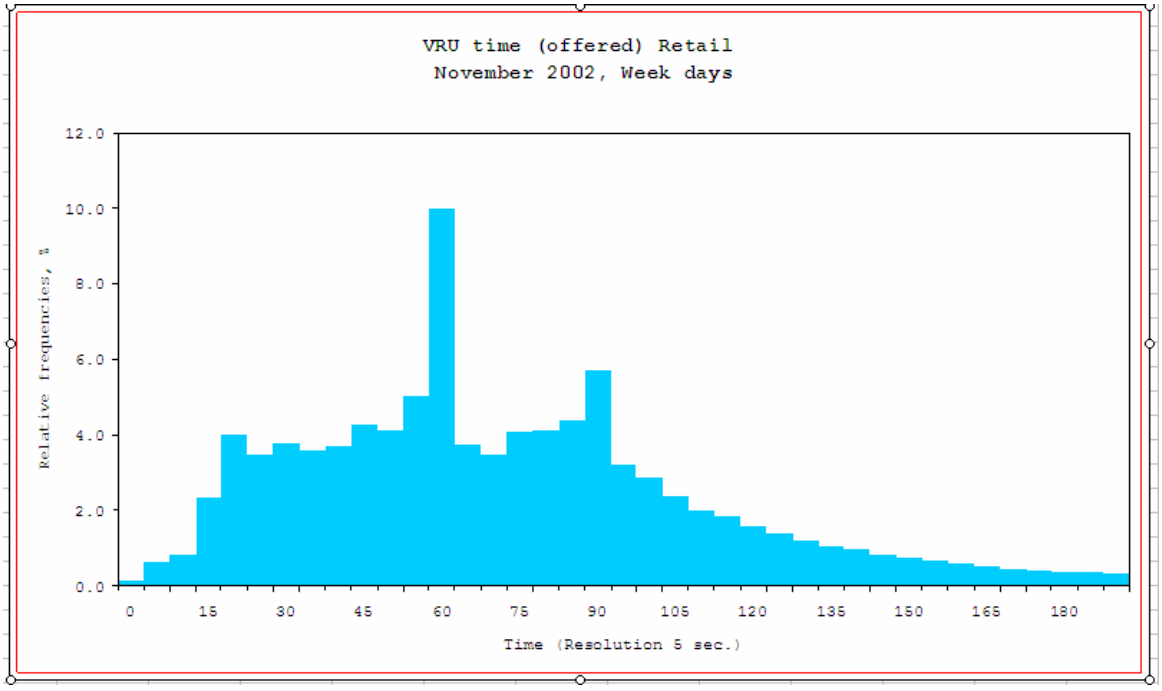

Agent status Private
April 2004, Week days
Average number of cases
60.0
50.0
40.0
30.0
20.0
10.0
0.0
0:00
2:00
4:00
6:00
8:00
10:00
12:00
14:00
16:00
18:00
20:00
22:00
0:00
Time (Resolution 5 min.)
Idle
Outgoing Call
Available
Incoming Call

Class variables

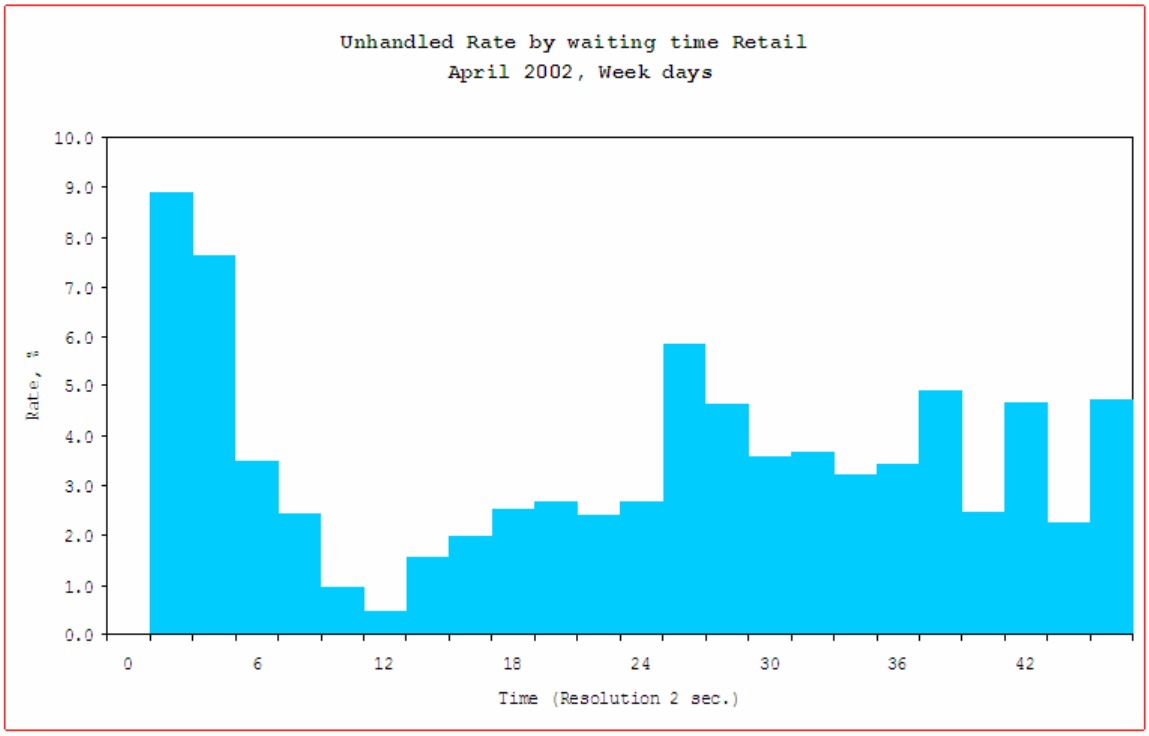
Distributions





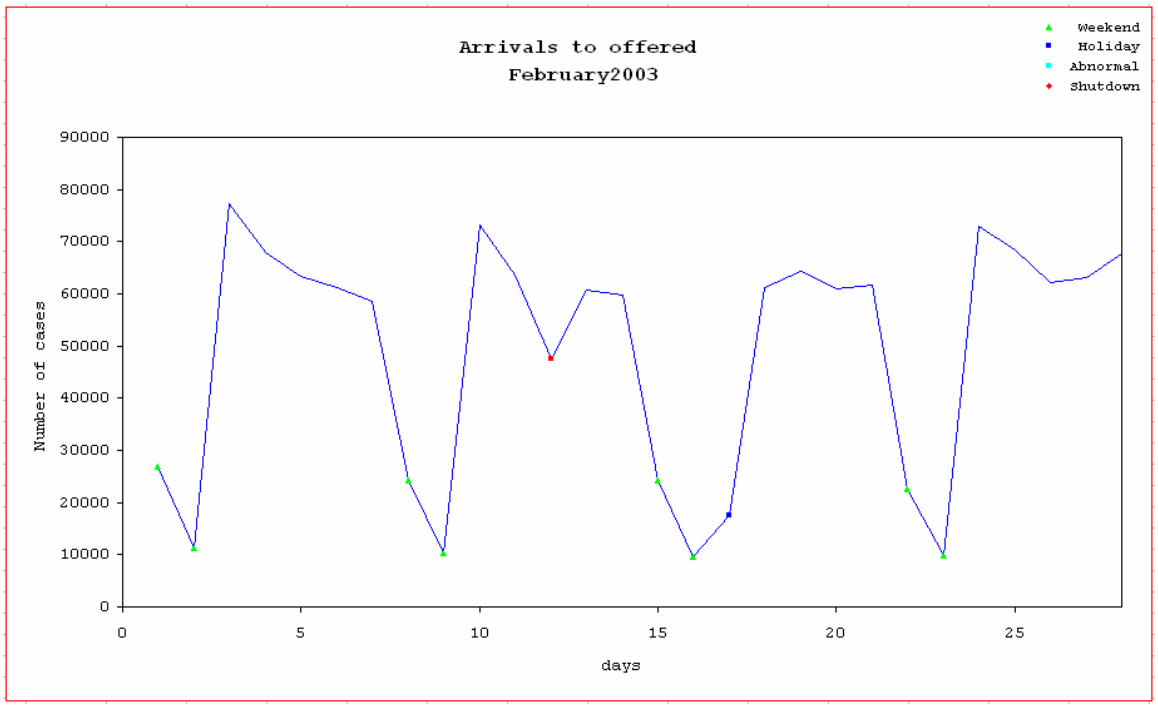

VRU time (offered) Retail
November 2002, Week days
Relative frequencies, %
12.0
10.0
8.0
6.0
4.0
2.0
0.0
0
15
30
45
60
75
90
105
120
135
150
165
180
Time (Resolution 5 sec.)

Rate

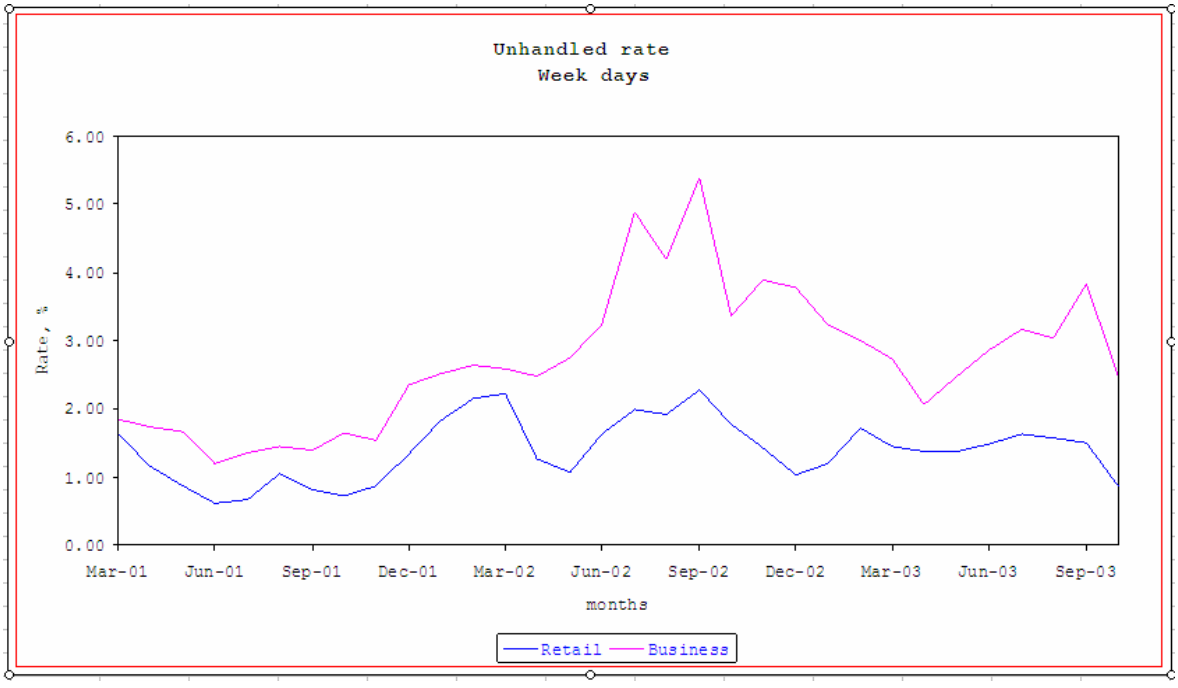

Unhandled Rate by waiting time Retail
April 2002, Week days
Rate, %
10.0
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
0
6
12
18
24
30
36
42
Time (Resolution 2 sec.)

11.5 Time Series Summaries

Days for one month

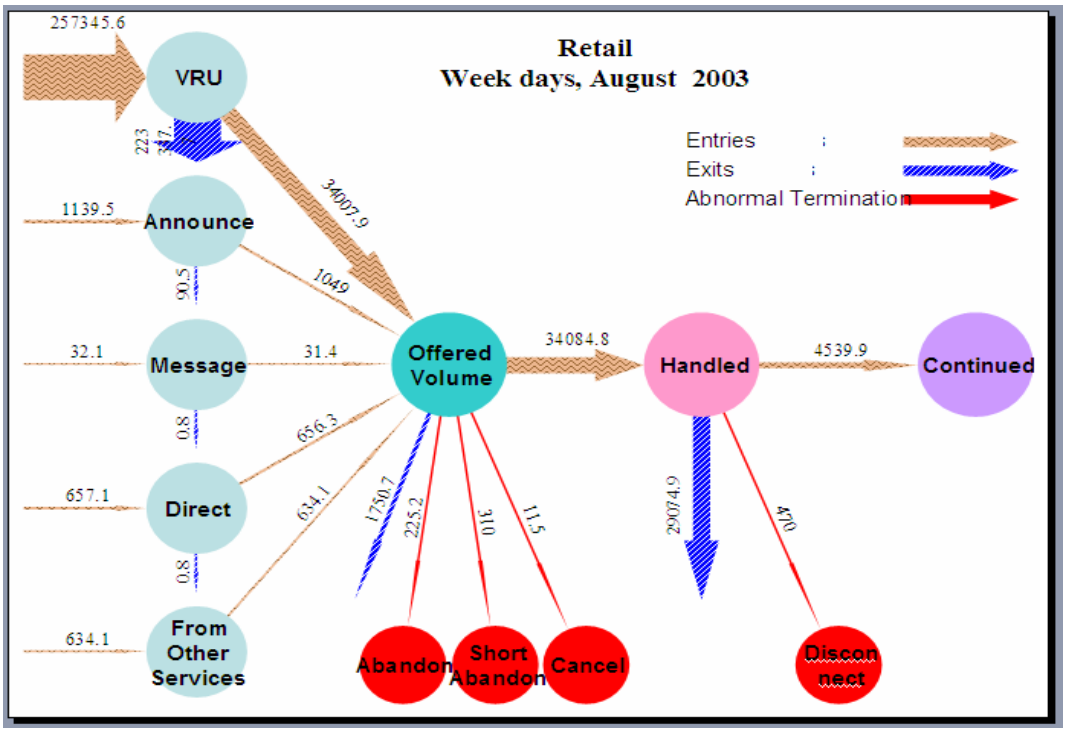


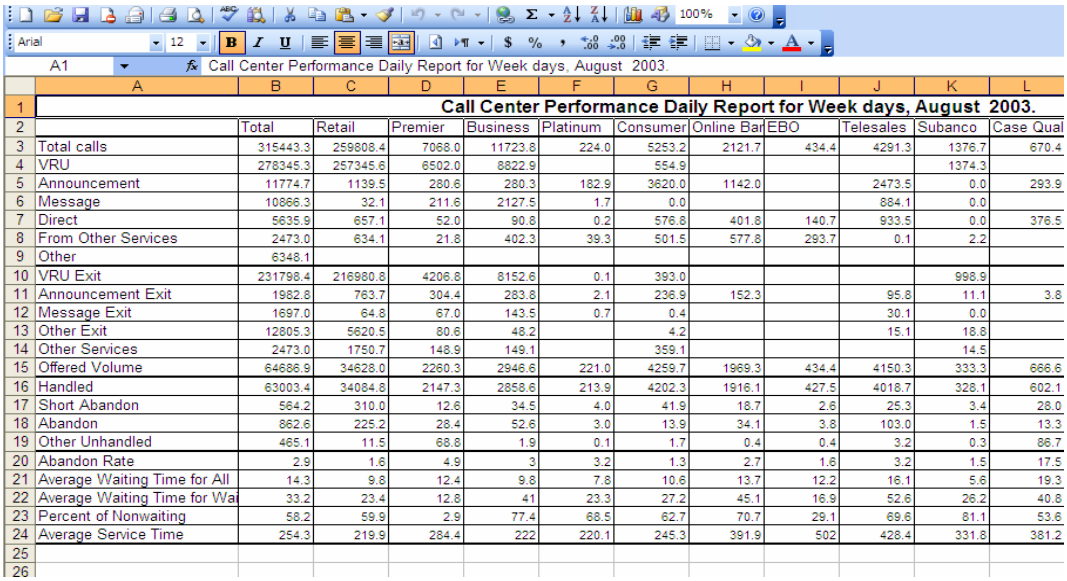
Aggregated days for months



11.6 Daily report

The interface to produce the daily report summary (table and/or chart) uses the same Tab Controls as for the *Daily Summaries* and *Time Series Summaries* interfaces in order to select the service type (for chart only) and the day (individual or aggregated). The daily report produces a chart like the one below, as well as an Excel table.



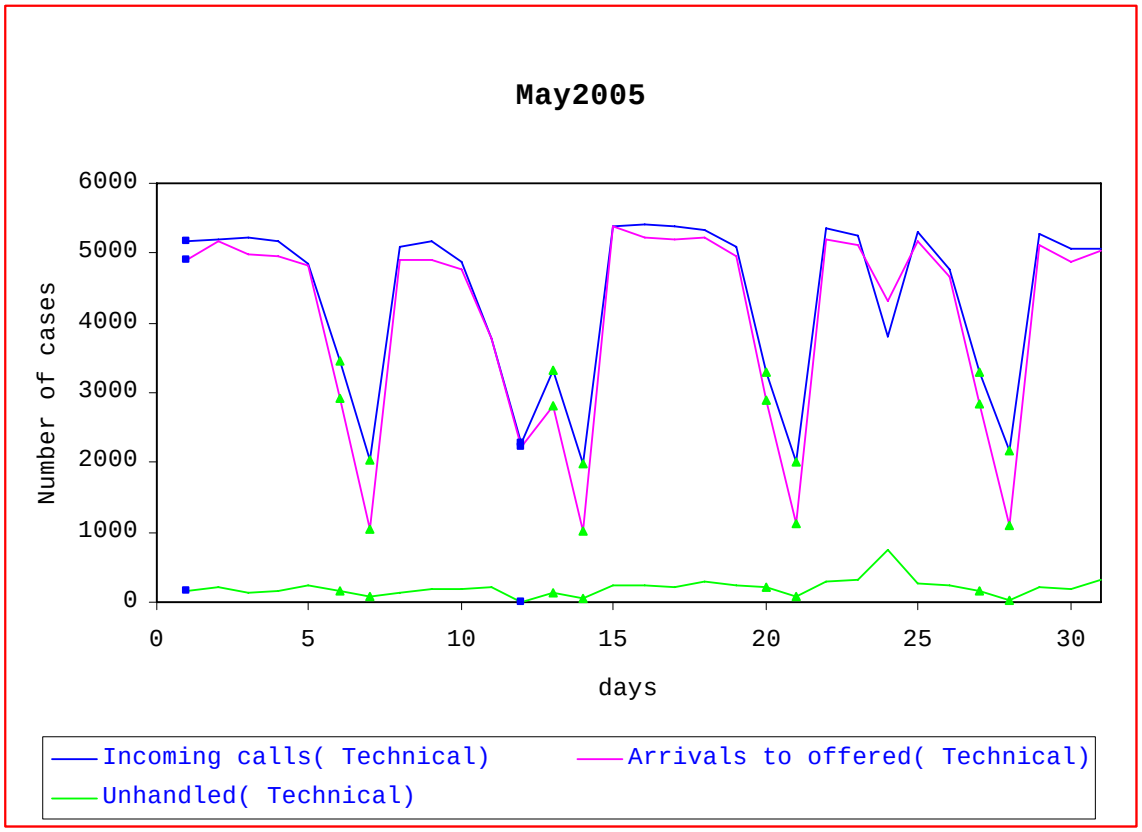


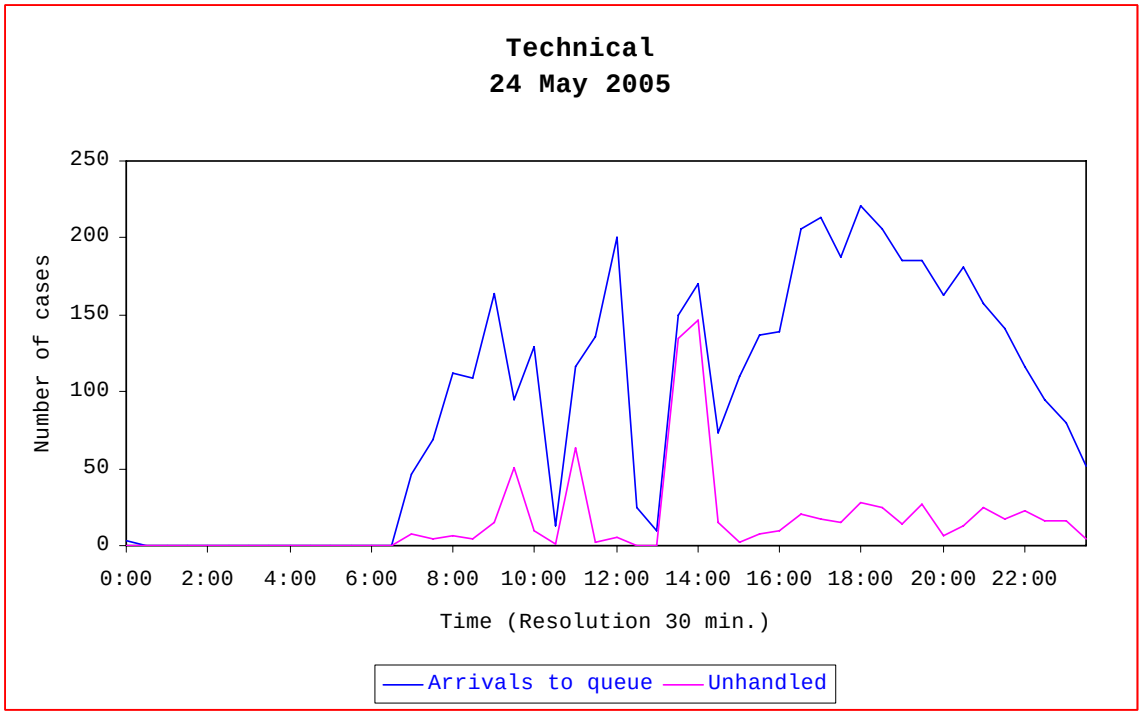
A1: Call Center Performance Daily Report for Week days, August 2003.

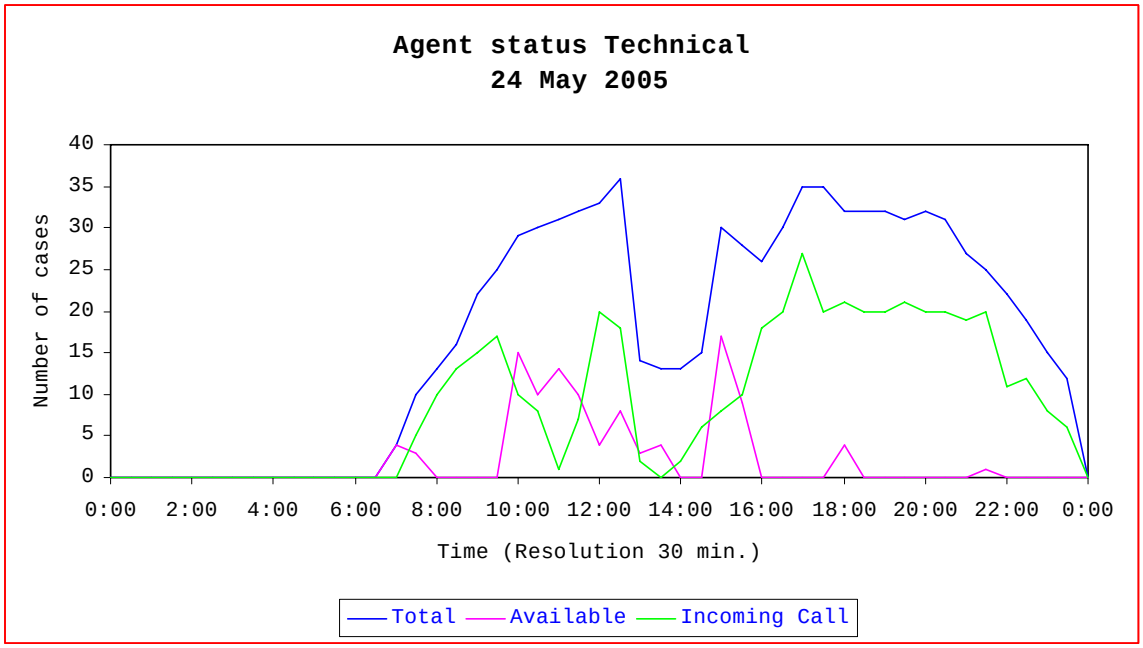
	A	B	C	D	E	F	G	H	I	J	K	L
1	Call Center Performance Daily Report for Week days, August 2003.											
2		Total	Retail	Premier	Business	Platinum	Consumer	Online Bar	EBO	Telesales	Subanco	Case Qual
3	Total calls	315443.3	259808.4	7068.0	11723.8	224.0	5253.2	2121.7	434.4	4291.3	1376.7	670.4
4	VRU	278345.3	257345.6	6502.0	8822.9		554.9				1374.3	
5	Announcement	11774.7	1139.5	280.6	280.3	182.9	3620.0	1142.0		2473.5	0.0	293.9
6	Message	10866.3	32.1	211.6	2127.5	1.7	0.0			884.1	0.0	
7	Direct	5635.9	657.1	52.0	90.8	0.2	576.8	401.8	140.7	933.5	0.0	376.5
8	From Other Services	2473.0	634.1	21.8	402.3	39.3	501.5	577.8	293.7	0.1	2.2	
9	Other	6348.1										
10	VRU Exit	231798.4	216980.8	4206.8	8152.6	0.1	393.0				998.9	
11	Announcement Exit	1982.8	763.7	304.4	283.8	2.1	236.9	152.3		95.8	11.1	3.8
12	Message Exit	1697.0	64.8	67.0	143.5	0.7	0.4			30.1	0.0	
13	Other Exit	12805.3	5620.5	80.6	48.2		4.2			15.1	18.8	
14	Other Services	2473.0	1750.7	148.9	149.1		359.1				14.5	
15	Offered Volume	64686.9	34628.0	2260.3	2946.6	221.0	4259.7	1969.3	434.4	4150.3	333.3	666.6
16	Handled	63003.4	34084.8	2147.3	2858.6	213.9	4202.3	1916.1	427.5	4018.7	328.1	602.1
17	Short Abandon	564.2	310.0	12.6	34.5	4.0	41.9	18.7	2.6	25.3	3.4	28.0
18	Abandon	862.6	225.2	28.4	52.6	3.0	13.9	34.1	3.8	103.0	1.5	13.3
19	Other Unhandled	465.1	11.5	68.8	1.9	0.1	1.7	0.4	0.4	3.2	0.3	86.7
20	Abandon Rate	2.9	1.6	4.9	3	3.2	1.3	2.7	1.6	3.2	1.5	17.5
21	Average Waiting Time for All	14.3	9.8	12.4	9.8	7.8	10.6	13.7	12.2	16.1	5.6	19.3
22	Average Waiting Time for Wai	33.2	23.4	12.8	41	23.3	27.2	45.1	16.9	52.6	26.2	40.8
23	Percent of Nonwaiting	58.2	59.9	2.9	77.4	68.5	62.7	70.7	29.1	69.6	81.1	53.6
24	Average Service Time	254.3	219.9	284.4	222	220.1	245.3	391.9	502	428.4	331.8	381.2
25												
26												

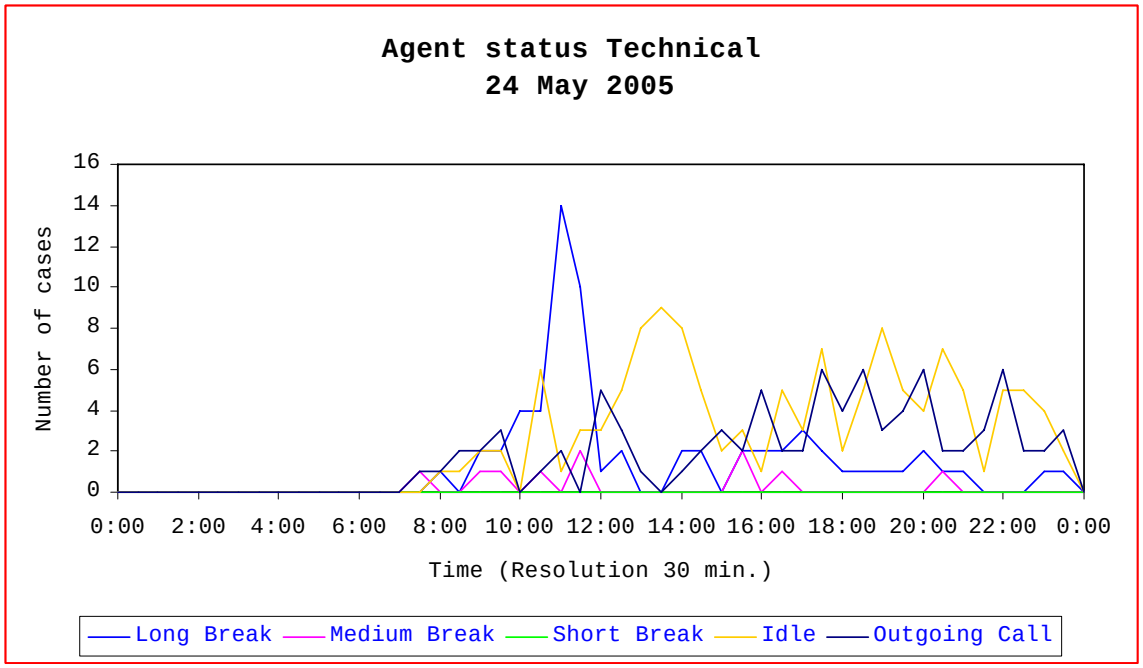
11.7 Sample Analysis of Peak Abandonment

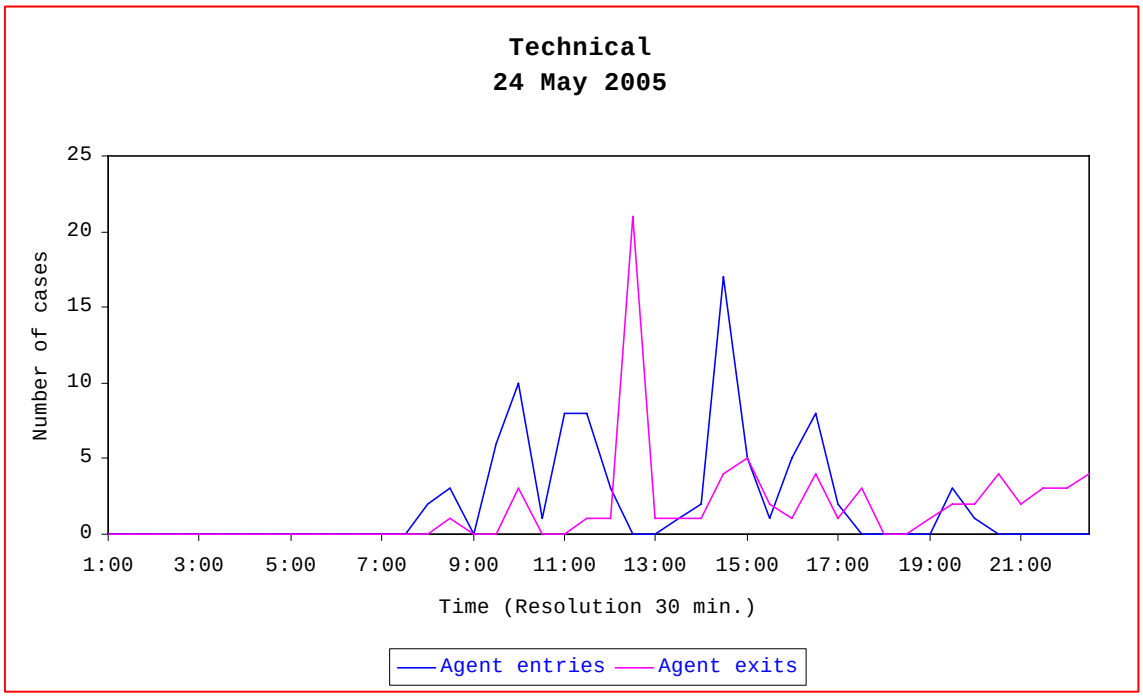
Here we demonstrate how DataMOCCA can be used to identify operational roots of congestion that cause deterioration in service levels. We envision such applications as supporting daily root-cause analysis, which is common in call centers.
The following scenario is described via DataMocca graphs:
- A monthly picture identifies a peak in the unhandled Technical calls, on Tuesday, May 24, 2005; - focusing on that day, we see that almost all calls between 13:00 and 15:00 were actually unhandled;
- it turns out, via Agent Status Technical, that there was a drastic drop in the number of agents available for service (from about 35 to about 15), exactly between 13:00-15:00;
- moreover, around 8 available agents were actually idle and 2 were handling outgoing calls;
- we then discover that 20 agents left their post at 13:00 and 16 joined at 15:00;
- this caused over 300 customers abandoning without being served;
- the final outcome of the analysis displays the number abandoning, jointly with agent-entries and agents-exists (scaled via "percent to mean"), which nails down the operational root-cause of this deterioration in service level.
It is now left for the managers of Technical to confront these findings: find out why 20 of their agents suddenly left their posts at 13:00 without being replaced and why the others did not handle incoming calls; then minimize the prevalence of such scenarios.

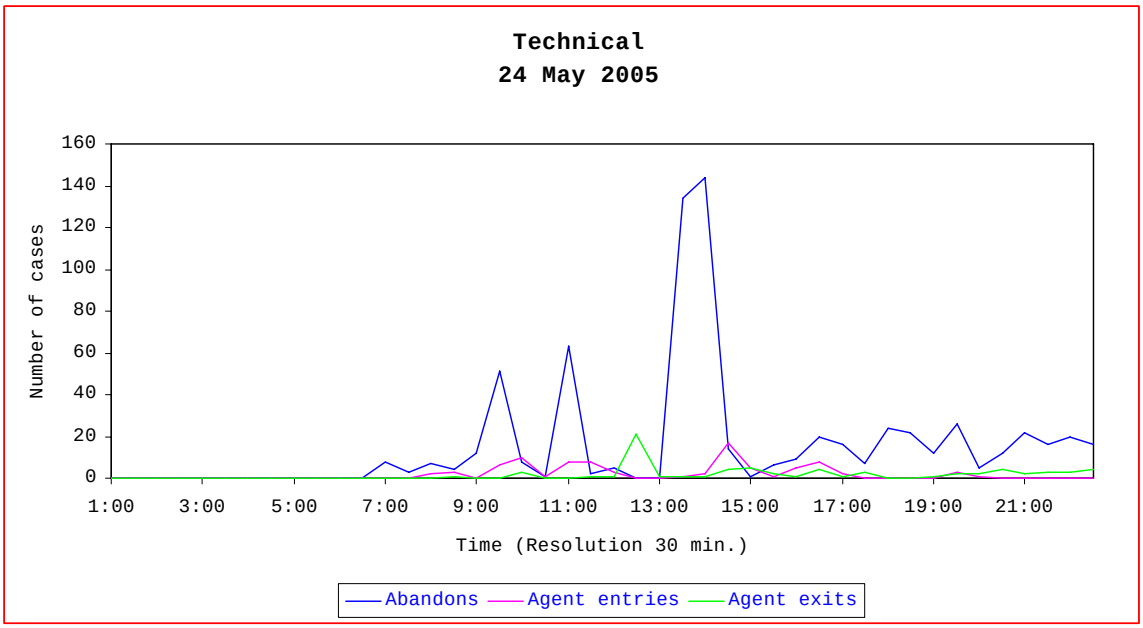


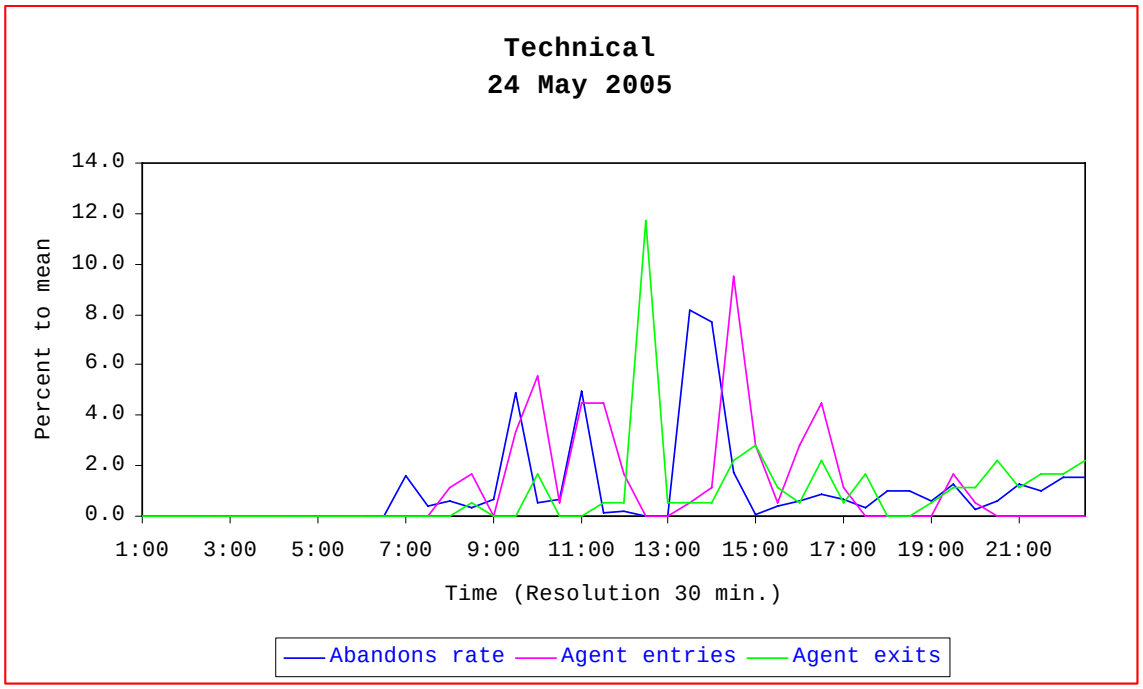

Technical
24 May 2005
Number of cases
250
200
150
100
50
0
0:00
2:00
4:00
6:00
8:00
10:00
12:00
14:00
16:00
18:00
20:00
22:00
Time (Resolution 30 min.)
Arrivals to queue
Unhandled


Agent status Technical
24 May 2005
Number of cases
40
35
30
25
20
15
10
5
0
0:00
2:00
4:00
6:00
8:00
10:00
12:00
14:00
16:00
18:00
20:00
22:00
0:00
Time (Resolution 30 min.)
Total
Available
Incoming Call


Agent status Technical
24 May 2005
Number of cases
16
14
12
10
8
6
4
2
0
0:00 2:00 4:00 6:00 8:00 10:00 12:00 14:00 16:00 18:00 20:00 22:00 0:00
Time (Resolution 30 min.)
Long Break
Medium Break
Short Break
Idle
Outgoing Call


Technical
24 May 2005
Number of cases
25
20
15
10
5
0
1:00 3:00 5:00 7:00 9:00 11:00 13:00 15:00 17:00 19:00 21:00
Time (Resolution 30 min.)
Agent entries
Agent exits


Technical
24 May 2005
Number of cases
160
140
120
100
80
60
40
20
0
1:00
3:00
5:00
7:00
9:00
11:00
13:00
15:00
17:00
19:00
21:00
Time (Resolution 30 min.)
Abandons
Agent entries
Agent exits


Technical
24 May 2005
Percent to mean
14.0
12.0
10.0
8.0
6.0
4.0
2.0
0.0
1:00
3:00
5:00
7:00
9:00
11:00
13:00
15:00
17:00
19:00
21:00
Time (Resolution 30 min.)
Abandons rate
Agent entries
Agent exits

12 Appendix 4 – Basic statistics for the ILTelecom Call Center

(an Israeli Telecom company)

12.1 A typical month - June 2004 and a highly loaded month - July 2005

	Typical month June 2004		Highly loaded month July 2005	
Total # of arriving calls	4,761,443	8.64%(% out of Yearly Total)	5,730,379	9.98(% out of Yearly Total)
# requesting agent service	1,186,879	24.93%(% out of Total entries)	1,379,076	24.07(% out of Total entries)
Handled calls	1,088,246	91.69%(% out of offered)	1,253,997	90.93(% out of offered)
number_of_waiting	697,114	58.74%(% out of offered)	903,911	65.54(% out of offered)
Caller Termination	483,576	44.49%(% out of Total Termination)	528,438	42.54(% out of Total Termination)
Agent Termination	357,136	32.86%(% out of Total Termination)	457,893	36.86(% out of Total Termination)
Undeterminate Termination	33,596	3.09%(% out of Total Termination)	240	0.02(% out of Total Termination)
Transfer	196,125	18.04%(% out of Total Termination)	235,706	18.97(% out of Total Termination)
Other Termination	16,474	1.52%(% out of Total Termination)	19,952	1.61(% out of Total Termination)

12.2 Basic statistics

Table 1: Monthly call counts (% out of yearly total)

Year 2004

month	Total # of arriving calls	%
January2004	4,283,191	7.77
February2004	4,230,241	7.68
March2004	4,440,209	8.06
April2004	4,114,995	7.47
May2004	4,478,679	8.13
June2004	4,761,443	8.64
July2004	4,878,214	8.85
August2004	5,163,545	9.37
September2004	4,360,480	7.91
October2004	4,696,372	8.52
November2004	4,702,416	8.54
December2004	4,982,232	9.04
Total2004	55,092,017	100
Average per month 2004	**4,591,001**	

Year 2005

month	Total # of arriving calls	%
January2005	4,863,880	8.47
February2005	5,381,371	9.38
March2005	5,243,314	9.14
April2005	4,903,509	8.54
May2005	5,387,734	9.39
June2005	5,173,399	9.01
July2005	5,730,379	9.98
August2005	5,734,206	9.99
September2005	5,347,793	9.32
October2005	4,280,336	7.46
November2005	5,350,472	9.32
Total2005	57,396,393	100
Average per month 2005	**5,217,854**	

Table 2: Handled/unhandled calls (% out of monthly total # calls arrivals to the queue)
Year 2004

month	# calls arrivals to the queue (offered)	handled	% handled	unhandled	% unhandled
January2004	1,095,719	985,897	90.0	109,822	10.0
February2004	1,086,516	988,812	91.0	97,704	9.0
March2004	1,131,412	1,044,963	92.4	86,449	7.6
April2004	1,057,887	936,170	88.5	121,717	11.5
May2004	1,127,888	1,019,550	90.4	108,338	9.6
June2004	1,186,879	1,088,246	91.7	98,633	8.3
July2004	1,199,999	1,103,468	92.0	96,531	8.0
August2004	1,280,249	1,177,393	92.0	102,856	8.0
September2004	1,071,459	991,552	92.5	79,907	7.5
October2004	1,123,599	1,050,424	93.5	73,175	6.5
November2004	1,146,134	1,065,332	93.0	80,802	7.0
December2004	1,205,442	1,117,355	92.7	88,087	7.3
Total	**13,713,183**	**12,569,162**	**91.7**	**1,144,021**	**8.3**
Average per moth 2004	**1,142,765.25**	**1,047,430.17**		**95,335.08**	

Year 2005

month	# calls arrivals to the queue (offered)	handled	% handled	unhandled	% unhandled
January2005	1,152,823	1,074,408	93.2	78,415	6.8
February2005	1,089,517	1,002,682	92.0	86,835	8.0
March2005	1,244,717	1,161,846	93.3	82,871	6.7
April2005	1,058,722	990,005	93.5	68,717	6.5
May2005	1,229,631	1,133,503	92.2	96,128	7.8
June2005	1,215,955	1,126,390	92.6	89,565	7.4
July2005	1,379,076	1,253,997	90.9	125,079	9.1
August2005	1,264,605	1,162,080	91.9	102,525	8.1
September2005	1,175,553	1,083,072	92.1	92,481	7.9
October2005	842,476	778,074	92.4	64,402	7.6
November2005	1,020,371	951,514	93.3	68,857	6.7
Total	**12,673,446**	**11,717,571**	**92.5**	**955,875**	**7.5**
Average per month 2005	**1,152,131.45**	**1,065,233.73**		**86,897.73**	

Table 3: Call counts by waiting status (% out of monthly total # calls arrivals to the queue)
Year 2004

month	# calls arrivals to the queue (offered)	number_of_waiting	% of waiting	No waiting	% of no waiting
January2004	1,095,719	638,418	58.3	457,301	41.7
February2004	1,086,516	603,115	55.5	483,401	44.5
March2004	1,131,412	635,926	56.2	495,486	43.8
April2004	1,057,887	664,639	62.8	393,248	37.2
May2004	1,127,888	679,443	60.2	448,445	39.8
June2004	1,186,879	697,114	58.7	489,765	41.3
July2004	1,199,999	700,396	58.4	499,603	41.6
August2004	1,280,249	718,108	56.1	562,141	43.9
September2004	1,071,459	595,381	55.6	476,078	44.4
October2004	1,123,599	588,088	52.3	535,511	47.7
November2004	1,146,134	609,376	53.2	536,758	46.8
December2004	1,205,442	661,012	54.8	544,430	45.2
Total	**13,713,183**	**7,791,016**	**56.8**	**5,922,167**	**43.2**
Average per month 2004	**1,142,765.25**	**649,251.33**		**493,513.92**	**43.2**

Year 2005

month	# calls arrivals to the queue (offered)	number_of_waiting	% of waiting	No waiting	% of no waiting
January2005	1,152,823	626,194	54.3	526,629	45.7
February2005	1,089,517	649,940	59.7	439,577	40.3
March2005	1,244,717	693,419	55.7	551,298	44.3
April2005	1,058,722	547,168	51.7	511,554	48.3
May2005	1,229,631	764,789	62.2	464,842	37.8
June2005	1,215,955	685,241	56.4	530,714	43.6
July2005	1,379,076	903,911	65.5	475,165	34.5
August2005	1,264,605	770,678	60.9	493,927	39.1
September2005	1,175,553	740,383	63.0	435,170	37.0
October2005	842,476	536,147	63.6	306,329	36.4
November2005	1,020,371	642,913	63.0	377,458	37.0
Total	**12,673,446**	**7,560,783**	**59.7**	**5,112,663**	**40.3**
Average per month 2005	**1,152,131.45**	**687,343.91**		**464,787.55**	

Table 4: Call Counts by service termination

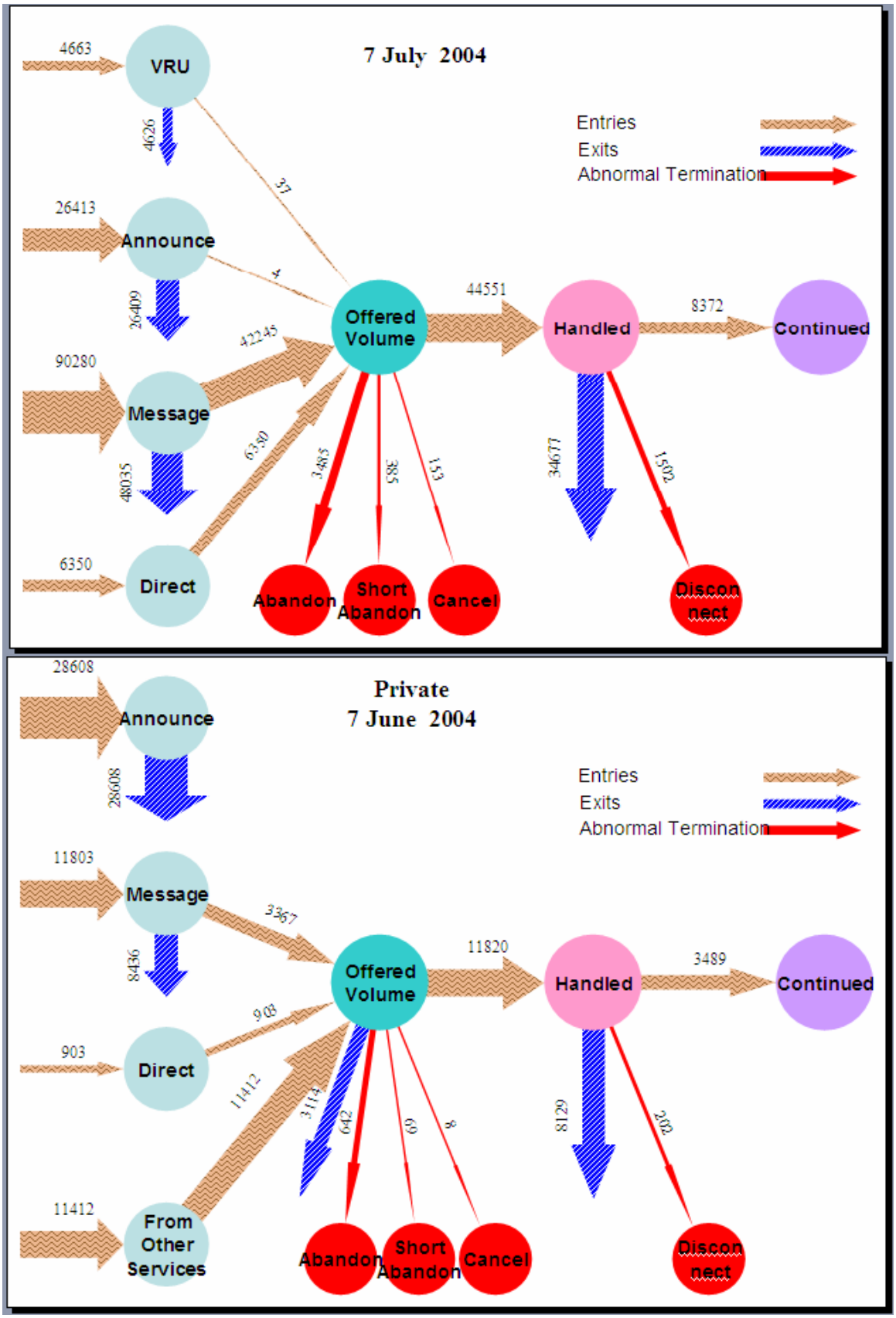
Year 2004

month	Caller Termin	% Caller Termin	Agent Termin	% Agent Term	Undetermi Termin	% Undeter Termin	Transfer	% Transfer	Other	% Other	Total
4-Jan	426,191	43.23%	293,625	29.78%	33,155	3.36%	213,299	21.64%	19,548	1.98%	985,818
4-Feb	427,658	43.25%	307,954	31.15%	32,440	3.28%	201,072	20.34%	19,624	1.98%	988,748
4-Mar	456,998	43.74%	328,951	31.49%	35,265	3.38%	205,163	19.64%	18,380	1.76%	1,044,757
4-Apr	408,654	43.67%	316,258	33.79%	29,247	3.13%	168,633	18.02%	13,066	1.40%	935,858
4-May	444,137	43.59%	336,481	33.02%	31,052	3.05%	192,751	18.92%	14,584	1.43%	1,019,005
4-Jun	483,576	44.49%	357,136	32.86%	33,596	3.09%	196,125	18.04%	16,474	1.52%	1,086,907
4-Jul	499,231	45.34%	353,213	32.08%	34,854	3.17%	196,865	17.88%	16,889	1.53%	1,101,052
4-Aug	527,040	44.85%	388,185	33.03%	38,266	3.26%	204,161	17.37%	17,433	1.48%	1,175,085
4-Sep	435,264	43.92%	331,943	33.49%	31,623	3.19%	177,185	17.88%	15,110	1.52%	991,125
4-Oct	457,464	43.59%	354,233	33.75%	32,480	3.09%	188,753	17.98%	16,610	1.58%	1,049,540
4-Nov	464,280	43.61%	351,035	32.97%	31,739	2.98%	201,129	18.89%	16,377	1.54%	1,064,560
4-Dec	490,872	43.95%	362,989	32.50%	33,507	3.00%	212,544	19.03%	17,086	1.53%	1,116,998

Year 2005

Year 2005 month	Caller Termin	% Caller Term	Agent Termin	% Agent Term	Undeter Termin	% Undeter Term	Transfer	% Transfer	Other	% other	Total
5-Jan	472,483	43.98%	356,493	33.18%	23,389	2.18%	205,711	19.15%	16,297	1.52%	1,074,373
5-Feb	428,562	43.08%	352,259	35.41%	6,491	0.65%	193,026	19.40%	14,544	1.46%	994,882
5-Mar	489,945	42.89%	416,117	36.43%	240	0.02%	217,894	19.07%	18,126	1.59%	1,142,322
5-Apr	417,249	42.80%	362,790	37.21%	173	0.02%	178,686	18.33%	16,001	1.64%	974,899
5-May	478,464	42.80%	412,212	36.87%	245	0.02%	208,720	18.67%	18,383	1.64%	1,118,024
5-Jun	477,635	42.79%	409,532	36.68%	176	0.02%	210,730	18.88%	18,278	1.64%	1,116,351
5-Jul	528,438	42.54%	457,893	36.86%	240	0.02%	235,706	18.97%	19,952	1.61%	1,242,229
5-Aug	467,609	40.75%	432,652	37.70%	223	0.02%	222,939	19.43%	24,135	2.10%	1,147,558
5-Sep	429,927	40.26%	406,857	38.10%	200	0.02%	209,449	19.61%	21,430	2.01%	1,067,863
5-Oct	314,196	40.94%	290,810	37.90%	142	0.02%	151,936	19.80%	10,321	1.34%	767,405
5-Nov	379,685	40.49%	345,542	36.85%	165	0.02%	196,932	21.00%	15,317	1.63%	937,641

12.3 Daily report IL Telecom (example):



13 Appendix 5 – Basic statistics for the USBank Call Center

(a US bank)

Table 1: Monthly call counts (% out of yearly total)

Year 2001

month	Total # of arriving calls	%
March2001 (26/03-31/03)	1,312,225	2.34%
April2001	5,354,743	9.53%
May2001	4,820,670	8.58%
June2001	5,592,138	9.96%
July2001	6,729,583	11.98%
August2001	6,262,038	11.15%
September2001	5,922,556	10.54%
October2001	6,865,859	12.22%
November2001	6,631,067	11.80%
December2001	6,682,635	11.90%
Total 2001	56,173,514	
Average per month 2001	6,105,817	

Year 2002

month	Total # of arriving calls	%
January2002	6,964,811	8.46%
February2002	6,442,941	7.83%
March2002	6,908,412	8.39%
April2002	7,163,178	8.70%
May2002	6,857,077	8.33%
June2002	6,721,987	8.17%
July2002	7,105,554	8.63%
August2002	7,098,799	8.62%
September2002	5,795,582	7.04%
October2002	7,029,396	8.54%
November2002	6,446,038	7.83%
December2002	7,785,089	9.46%
Total 2001	82,318,864	
Average per month 2001	6,859,905	

Year 2003

month	Total # of arriving calls	%
January2003	8,340,522	10.48%
February2003	8,403,736	10.56%
March2003	8,606,779	10.82%
April2003	7,081,624	8.90%
May2003	8,047,694	10.12%
June2003	8,178,286	10.28%
July2003	8,477,345	10.66%
August2003	8,135,475	10.23%
September2003	7,745,113	9.74%
October2003 (1/10-26/10)	6,538,536	8.22%
Total 2001	79,555,110	
Average per month 2001	8,084,869	

Table 2: Handled/unhandled calls (% out of monthly total # calls arrivals to the queue)

Year 2001

month	# calls arrivals to the queue (offered)	handled	% handled	unhandled	% unhandled
March2001 (26/03-31/03)	278,340	269,499	96.82%	8,841	3.18%
April2001	1,148,091	1,126,077	98.08%	22,014	1.92%
May2001	1,071,441	1,055,407	98.50%	16,034	1.50%
June2001	1,228,083	1,210,288	98.55%	17,795	1.45%
July2001	1,569,311	1,544,312	98.41%	24,999	1.59%
August2001	1,421,573	1,398,687	98.39%	22,886	1.61%
September2001	1,241,439	1,227,211	98.85%	14,228	1.15%
October2001	1,461,667	1,430,883	97.89%	30,784	2.11%
November2001	1,317,845	1,302,535	98.84%	15,310	1.16%
December2001	1,290,754	1,269,218	98.33%	21,536	1.67%
Total	**12,028,544**	**11,834,117**	98.38%	**194,427**	1.62%
Average per moth 2001	**1,307,450**	**1,286,317**		**21,133**	

Year 2002

month	# calls arrivals to the queue (offered)	handled	% handled	unhandled	% unhandled
Jan-02	1,407,885	1,381,595	98.13%	26,290	1.87%
Feb-02	1,283,705	1,254,821	97.75%	28,884	2.25%
Mar-02	1,373,182	1,340,953	97.65%	32,229	2.35%
Apr-02	1,300,913	1,281,508	98.51%	19,405	1.49%
May-02	1,218,224	1,202,039	98.67%	16,185	1.33%
Jun-02	1,182,492	1,159,417	98.05%	23,075	1.95%
Jul-02	1,336,457	1,303,051	97.50%	33,406	2.50%
Aug-02	1,354,110	1,320,471	97.52%	33,639	2.48%
Sep-02	1,069,983	1,036,895	96.91%	33,088	3.09%
Oct-02	1,294,056	1,258,930	97.29%	35,126	2.71%
Nov-02	1,113,198	1,077,099	96.76%	36,099	3.24%
Dec-06	1,456,581	1,388,237	95.31%	68,344	4.69%
Total	**15,390,786**	**15,005,016**	97.49%	**385,770**	2.51%
Average per moth 2002	**1,282,566**	**1,250,418**		**32,148**	

Year 2003

month	# calls arrivals to the queue (offered)	handled	% handled	unhandled	% unhandled
January2003	1,508,497	1,467,000	97.25%	41,497	2.75%
February2003	1,307,342	1,270,903	97.21%	36,439	2.79%
March2003	1,524,002	1,486,669	97.55%	37,333	2.45%
April2003	1,301,752	1,272,639	97.76%	29,113	2.24%
May2003	1,412,498	1,379,132	97.64%	33,366	2.36%
June2003	1,445,121	1,408,032	97.43%	37,089	2.57%
July2003	1,616,095	1,564,755	96.82%	51,340	3.18%
August2003	1,521,577	1,473,751	96.86%	47,826	3.14%
September2003	1,439,791	1,398,239	97.11%	41,552	2.89%
October2003 (1/10-26/10)	1,150,137	1,122,598	97.61%	27,539	2.39%
Total	**14,226,812**	**13,843,718**	97.31%	**383,094**	2.69%
Average per moth 2003	**1,445,814**	**1,406,882**		**38,932**	

Table 3: Call counts by waiting status (% out of monthly total # calls arrivals to the queue)
Year 2001

month	# calls arrivals to the queue (offered)	number_of_waiting	% of waiting	no_waiting	% of no waiting
March2001 (26/03-31/03)	278,340	95,868	34.44%	182,472	65.56%
April2001	1,148,091	283,701	24.71%	864,390	75.29%
May2001	1,071,441	202,853	18.93%	868,588	81.07%
June2001	1,228,083	186,584	15.19%	1,041,499	84.81%
July2001	1,569,311	315,663	20.11%	1,253,648	79.89%
August2001	1,421,573	374,236	26.33%	1,047,337	73.67%
September2001	1,241,439	230,015	18.53%	1,011,424	81.47%
October2001	1,461,667	349,303	23.90%	1,112,364	76.10%
November2001	1,317,845	292,060	22.16%	1,025,785	77.84%
December2001	1,290,754	363,163	28.14%	927,591	71.86%
Total	**12,028,544**	**2,693,446**	22.39%	**9,335,098**	77.61%
Average per month 2001	**1,307,450**	**292,766**		**1,014,685**	

Year 2002

month	# calls arrivals to the queue (offered)	number_of_waiting	% of waiting	no_waiting	% of no waiting
January2002	1,407,885	427,474	30.36%	980,411	69.64%
February2002	1,283,705	446,367	34.77%	837,338	65.23%
March2002	1,373,182	471,690	34.35%	901,492	65.65%
April2002	1,300,913	303,706	23.35%	997,207	76.65%
May2002	1,218,224	293,131	24.06%	925,093	75.94%
June2002	1,182,492	357,855	30.26%	824,637	69.74%
July2002	1,336,457	514,465	38.49%	821,992	61.51%
August2002	1,354,110	544,654	40.22%	809,456	59.78%
September2002	1,069,983	493,317	46.11%	576,666	53.89%
October2002	1,294,056	462,880	35.77%	831,176	64.23%
November2002	1,113,198	399,210	35.86%	713,988	64.14%
December2002	1,456,581	539,645	37.05%	916,936	62.95%
Total	**15,390,786**	**5,254,394**	34.14%	**10,136,392**	65.86%
Average per month 2002	**1,282,565**	**437,866**		**844,699**	

Year 2003

month	# calls arrivals to the queue (offered)	number_of_waiting	% of waiting	no_waiting	% of no waiting
January2003	1,508,497	510,290	33.83%	998,207	66.17%
February2003	1,307,342	493,527	37.75%	813,815	62.25%
March2003	1,524,002	484,332	31.78%	1,039,670	68.22%
April2003	1,301,752	406,154	31.20%	895,598	68.80%
May2003	1,412,498	460,580	32.61%	951,918	67.39%
June2003	1,445,121	513,553	35.54%	931,568	64.46%
July2003	1,616,095	683,105	42.27%	932,990	57.73%
August2003	1,521,577	646,020	42.46%	875,557	57.54%
September2003	1,439,791	541,615	37.62%	898,176	62.38%
October2003 (1/10-26/10)	1,150,137	325,377	28.29%	824,760	71.71%
Total	**14,226,812**	**5,064,553**	35.60%	**9,162,259**	64.40%
Average per month 2003	**1,445,814**	**514,690**		**931,124**	

Table 4: Call Counts by service termination
Year 2001

month	Caller Termin	% Caller Term	Agent Termin	% Agent Term	Undeter Termin	% Undeter Term	Transfer	% Transfer	Total
Mar-01 (26/03-31/03)	187,985	69.87%	42,769	15.90%	3,946	1.47%	34,357	12.77%	269,057
Apr-01	791,426	70.38%	181,343	16.13%	14,967	1.33%	136,712	12.16%	1,124,448
May-01	720,735	68.39%	190,042	18.03%	12,647	1.20%	130,436	12.38%	1,053,860
Jun-01	821,643	68.05%	218,230	18.07%	14,343	1.19%	153,279	12.69%	1,207,495
Jul-01	1,038,110	67.39%	272,965	17.72%	20,191	1.31%	209,137	13.58%	1,540,403
Aug-01	943,010	67.60%	250,298	17.94%	19,665	1.41%	181,935	13.04%	1,394,908
Sep-01	827,518	67.70%	223,254	18.26%	15,574	1.27%	155,991	12.76%	1,222,337
Oct-01	962,989	67.42%	256,539	17.96%	19,017	1.33%	189,824	13.29%	1,428,369
Nov-01	883,109	67.86%	231,855	17.82%	17,185	1.32%	169,244	13.00%	1,301,393
Dec-01	879,353	69.35%	218,684	17.25%	16,644	1.31%	153,286	12.09%	1,267,967

Year 2002

month	Caller Termin	% Caller Term	Agent Termin	% Agent Term	Undeter Termin	% Undeter Term	Transfer	% Transfer	Total
Jan-02	967,347	70.06%	227,398	16.47%	17,662	1.28%	168,405	12.20%	1,380,812
Feb-02	896,540	71.52%	189,981	15.16%	16,308	1.30%	150,678	12.02%	1,253,507
Mar-02	959,435	71.62%	197,015	14.71%	17,392	1.30%	165,865	12.38%	1,339,707
Apr-02	917,980	71.64%	185,641	14.49%	15,922	1.24%	161,758	12.62%	1,281,301
May-02	862,535	71.77%	174,731	14.54%	14,141	1.18%	150,360	12.51%	1,201,767
Jun-02	836,938	72.21%	165,319	14.26%	13,891	1.20%	142,953	12.33%	1,159,101
Jul-02	937,007	72.01%	184,057	14.15%	17,273	1.33%	162,878	12.52%	1,301,215
Aug-02	952,189	72.17%	179,909	13.64%	18,261	1.38%	168,946	12.81%	1,319,305
Sep-02	752,977	73.08%	132,983	12.91%	13,686	1.33%	130,759	12.69%	1,030,405
Oct-02	904,102	71.92%	169,804	13.51%	17,401	1.38%	165,812	13.19%	1,257,119
Nov-02	745,608	70.07%	170,404	16.01%	13,803	1.30%	134,343	12.62%	1,064,158
Dec-02	925,285	68.43%	249,730	18.47%	17,293	1.28%	159,789	11.82%	1,352,097

Year 2003

month	Caller Termin	% Caller Term	Agent Termin	% Agent Term	Undeter Termin	% Undeter Term	Transfer	% Transfer	Total
Jan-03	982,878	68.16%	264,878	18.37%	17,427	1.21%	176,773	12.26%	1,441,956
Feb-03	864,300	68.62%	226,212	17.96%	15,263	1.21%	153,729	12.21%	1,259,504
Mar-03	999,051	67.78%	266,642	18.09%	17,766	1.21%	190,508	12.92%	1,473,967
Apr-03	866,712	68.78%	223,023	17.70%	14,414	1.14%	156,032	12.38%	1,260,181
May-03	945,070	69.26%	237,454	17.40%	15,715	1.15%	166,219	12.18%	1,364,458
Jun-03	960,852	69.10%	245,160	17.63%	16,509	1.19%	168,092	12.09%	1,390,613
Jul-03	1,058,864	68.93%	270,531	17.61%	19,610	1.28%	187,248	12.19%	1,536,253
Aug-03	1,007,527	69.00%	254,078	17.40%	19,182	1.31%	179,304	12.28%	1,460,091
Sep-03	965,233	69.91%	230,167	16.67%	17,673	1.28%	167,644	12.14%	1,380,717
Oct-03 (1/1026/10)	781,306	70.47%	181,088	16.33%	13,855	1.25%	132,480	11.95%	1,108,729