Contact Centers
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Call centre: “An area in an organization where business is conducted by phone in a methodical and organized way.”
Harry Newton
Newton's Telecom Dictionary, 16th Ed.
Overall Goal:

• Manage customer contacts with your company to:
  – Maximize revenue.
    » Want high customer satisfaction
  – Minimize cost to the company.
    » Want low:
      • telecom vendor bills
      • cost of facilities, including buildings, telecom equipment, utilities, etc.
      • employee headcount

• Very complex optimization.
A Traditional Call Center Is:

• Is staffed by human employees, i.e. agents
  – But… increasing preference for machines
• Physical place
  – But… may be virtual w/ agents at home
• Handles telephone calls
  – But… now also fax, email, web interaction
    » Similar strategies, similar performance issues
• **Fundamental questions:**
  – Which agents talk to which callers?
The Ideal

• Callers have unique resumes:
  – needs, wants, intentions
  – value to company

• Employees have unique resumes:
  – abilities, compensation, assignments, location, availability

• Resume matching -- connecting caller to most appropriate employee in the most appropriate way.

• This is what we want to approximate.
Caveat

• Even traditional call centers vary widely:
  – Size
  – Mission
• Therefore, what works for one is often inappropriate for another.
Tools to Accomplish Call Center Goals

• Automated Attendant
• Audiotex
• Voice Mail
• IVR -- Interactive Voice Response
• ACD -- Automatic Call Distribution
• Predictive Dialer
Automated Attendant

- Ordinary English name is descriptive.
- Typical simple scenario:
  - Plays message to caller "Thanks for calling HugeCorp. If you know the extension of the party you're trying to reach, enter it now. Press # for a directory. Press 0 for an operator."
  - Detect DTMF tones.
  - Transfer call to appropriate extension.
Audiotex Defined

- Audiotex:
  - nested menus leading to informational messages and/or
  - caller chooses from a predefined list of messages
- Any caller can hear any message.
  - There is no attempt to identify the callers.
- One-way communication
- Same as audiotext
  - English is a flexible language!
IVR

- Interactive Voice Response
- Narrow interpretation: caller enters DTMF, computer processes it, and gives caller audio feedback.
- How is IVR different from Audiotex?
  - Callers receive customized messages.
- Broad interpretation: phone is I/O device into computer, e.g.
  - Teletax tells you status of your tax return.
ACD

• Automatic Call Distribution
• Potential use whenever callers want to talk to someone, but not a particular someone. Generic term: agents.
  – Order taking
  – Product support
  – Account assistance
Goal of ACD

- Efficient connection of callers to agents.
- Why is this not a no-brainer?
  - Agents get paid whether they are talking or waiting.
  - Callers don't like waiting or busy signals.
  - Waiting callers run up 800 phone bills.
  - Idle trunks cost wasted monthly charges.
  - Calls arrive randomly, i.e. Poisson distributed.
- Complexity muddies optimization.
Basic ACD Strategy

- $N_{TRUNKS} > N_{AGENTS}$
  - Callers who call during peaks wait on hold until an agent is available.
- We have:
  - $N_{AGENTS}$ = number of agents
  - $t$ = mean talk time
  - $R$ = call arrival rate
  - $N_{TRUNKS}$ = number of trunks
Traffic Engineering

- This is a relatively simple queuing theory problem. We can solve for:
  - Mean wait in queue
  - % of callers who get busy signals
- But it's not always done.
  - Larger call centers are more likely to do this than smaller ones.
Traffic Engineering

• Why not do formal modeling?
• Many / most smaller call centers:
  – Don't know R in advance.
  – Don't have budget to freely adjust $N_{TRUNKS}$ or $N_{AGENTS}$.
  – Usually make initial guess, make changes incrementally.
Implementation Alternatives

- There are tons of implementation alternatives.
- Some major approaches:
  - Specialized PBXs
  - Standard PBXs with call center features
  - Standard PBXs controlled by external servers
- Can be circuit-switched or VoIP.
- Often integrated with other software:
  - Order taking, processing
  - Work flow management
  - CRM – Customer Relationship Management
What Happens First?

• Ideally, we want to know all we can about the caller.
• There are quite a few ways to find things out.
  – Sometimes used in combination.
Sources of Information about Caller

• Human receptionist
  – Caller tells what he/she wants or who she/he is.

• Automated attendant system
  – Caller explicitly chooses what he/she wants.

• IVR system
  – Caller enters account code or other id info.
  – Database can include lots of caller info.
More Sources of Info about Caller

- **ANI / CallerID**
  - Telco tells us where caller's calling from.
  - Highly variable in value.
- **DNIS / DID**
  - Telco tells us the number that the caller dialed.
  - Can have multiple numbers routed to one circuit group.
- **Trunk or circuit ID**
  - We know which circuit call arrived on.
  - For instance: circuits 1-8 for service, 9-24 for sales.
ANI

- Automatic Number Identification
- = Caller ID
- The call recipient is told the number of the caller.
  - In-band, as in residential caller id.
  - Out-of-band, as in ISDN.
- For callers from PBX, can get:
  - main billing number
  - number of specific line
  - DID number, if any
DNIS

- Dialed Number Identification Service
- The call recipient can have several 800-numbers routed to the same inbound trunk group.
- The recipient is told which number the caller dialed.
  - In-band, as digitized tones in a T1.
  - Out-of-band, as in ISDN.
Agent Groups

• All agents are not the same:
  – sales / support
  – different product lines
  – different levels of expertise
  – different levels of payment

• Divide agents into groups.

• Each group has its own separate queue.

• Calls are associated with groups based on what we know about the caller.
  – ANI, DNIS, IVR, etc.
Once a Call is in A Group

• What do we do with it?
• Generally, the administrator creates a routing table for each group.
  – Instructions to be applied sequentially to each call.
Some Basic Routing Table Commands

• DISTRIBUTED
  – If an agent is available, send the call to the agent. Waiting callers hear hold source.

• ANNOUNCEMENT
  – Play a pre-recorded announcement to the caller.

• GOTO
  – Like a goto in a computer program, call processing is shifted to another step in the table. This allows loops.
A Basic Routing Table

• We now have enough power to make a simple, but useful, routing table:
  1:  ANNOUNCEMENT 1
  2:  DISTRIBUT 0:20
  3:  ANNOUNCEMENT 2
  4:  DISTRIBUT 0:20
  5:  ANNOUNCEMENT 3
  6:  DISTRIBUT 0:40
  7:  GOTO 5
What If There's > 1 Available Agent?

• Several decision mechanisms:
  – Longest idle - Gives the call to the agent who's been idle the longest. Easy to implement, generally spreads calls evenly.
  – Top-down - Agents are ordered in a list. Call goes to whoever's closest to the top. Good in commission situation.
  – Least talk time - Gives the call to the agent who's spent the least time on ACD calls this shift.
What If There's > 1 Call in Queue?

• Newly available agent gets oldest call.

• Note: Never have multiple agents available and multiple calls in queue. Ever.
Pretend You're An Agent

• You're in one of a limited number of states:
  – logged out
  – available
  – unavailable
  – on an ACD call
  – on a non-ACD call
  – ringing - Your phone is ringing with a call.
  – wrap - Wrap time is time allotted at the end of a call to wrap up paperwork, etc. You aren't available for a call.
Reports

• The system generates a variety of reports for the call center manager.

• Agent-oriented Reports
  – Time in each state
  – Calls answered
  – Ave time to answer
  – Login, logout time
More Management Concerns

• What else are you interested in?
• Call-oriented reports:
  » Usually by hour or half-hour or shift
  – Number of calls received, answered, abandoned
  – Average time in queue
  – Average time to abandon
  » ANI for abandoned calls
• Of course, all of the management tools, i.e. reporting and real-time status display, are available separately for the separate groups.
What's Happening Now?

• Most systems will have a real-time status display or displays:
  – Physically:
    » Display board mounted on wall
    » Brief version on phone LCD w/ call stats
    » PC display box
  – For the agents:
    » Typically:
      • # calls in queue
      • age of oldest call
What's Happening Now?

• Most systems will have a real-time status display or displays:
  – For the manager:
    » Agent stats
      • # in each state
      • State of each individual
    » Call stats
      • # calls in queue
      • ave time in queue
      • age of oldest call in queue
What Happens at 5:00?

- Decent ACD systems have multiple routing tables, selected on basis of:
  - time of day
  - day of week
  - holiday
  - emergencies / exceptions
    » bomb scares, company meetings, etc.
B&W: Call Priority

• All callers aren't equally important. For instance, there may be:
  – big & small spenders
  – multiple levels of paid support
• How can we tell which calls should have high priority?
  – Human receptionist
  – Automated attendant
  – IVR
  – ANI
  – Different trunk groups or T-1 circuit groups
  – DNIS
Call Priority, Groups, & Call Answering

- A single group may have calls of multiple priorities.
  - All will hear same messages, traverse same routing table.
- Newly available agent gets oldest call of highest priority in his/her groups.
- 'Parallel' groups allow high priority callers to hear different announcements.
- Low priority calls may never be distributed.
  - Good ACD allows aged calls to increase in priority.
- If all calls are same priority, oldest answered first!
B&W: Abandoned Calls and ANI

• Frequently, an abandoned call means a missed sale.
• ANI is sometimes good -
  – Agents can, in slack times, call the would-be customer and make the sale.
• ANI is frequently useless -
  – Often returning a call based on the ANI will get you "Thank you for calling General Motors, how may I direct your call?"
B&W: The Boss Is Listening In

- Frequently, the system is set up so that the manager can listen in on conversations.
- Why?
  - Training
  - Agent assistance
    » Agent can signal for help
  - Recognizing abusive callers
B&W: The Boss Is Recording

• Frequently, the system is set up so that the manager or agent can record calls.
• Why?
  – Training
  – Callers who deny placing orders, etc.
  – Building dismissal case against agents
Eavesdropping

- Often, neither the agent nor the caller is aware of the eavesdropping and/or recording.
  - Agent can be told that calls are sometimes monitored.
- Note: IRS ACD, and many others, warn callers that calls may be recorded. Brokerages routinely record all calls and explicitly say so.