Call-Routing Schemes for Call-Center Outsourcing

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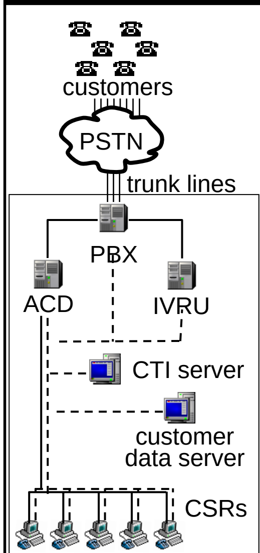
Outline

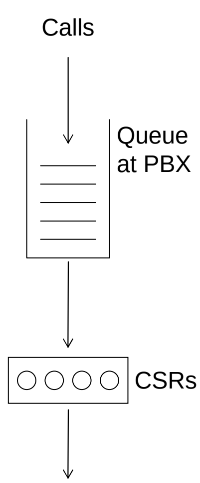
- Quick Background
  - call-center outsourcing
  - call-center infrastructure and operations
- Coordination of in-house and outsourcer operations
  - 4 schemes that vary in complexity
- Evaluating the coordination schemes
  - what numbers of agents each requires at the outsourcer
  - how difficult to determine required numbers at the outsourcer
- Implications for coordination
  - Infrastructure, staffing-level coordination, and contract design

Quick Background on Call-Center Outsourcing

- It's a growing business
  - Gartner Group estimates $8.4 billion in 2004 (to $12.2 billion in 2007)
  - Big US-based outsourcers such as Convergys
  - Growing off-shore outsourcing industry
- Often companies outsource some, but not all, of their calls
  - Keep "important" customers or calls in-house
  - Outsource the "bad" customers or specific types of calls
  - Often extra in-house capacity, so take bad calls in-house too
- Need to coordinate the two types of traffic
  - Must ID arriving calls – caller and/or call type
  - Must route the traffic on the fly, based on the ID
  - Must perform routing subject to service-level constraints

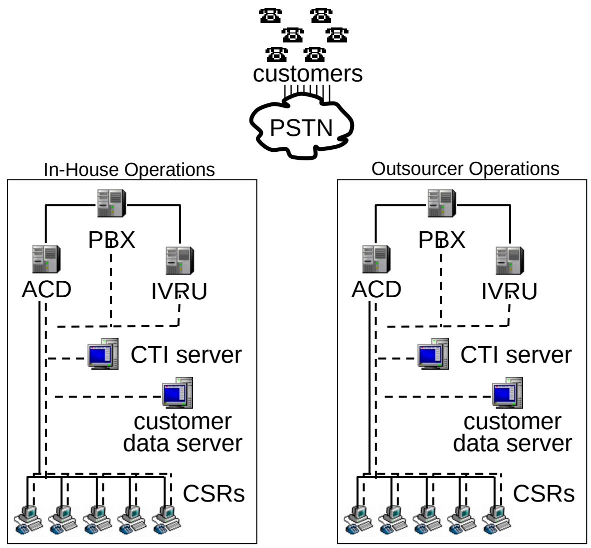
Infrastructure and Capacity Management: Single Center



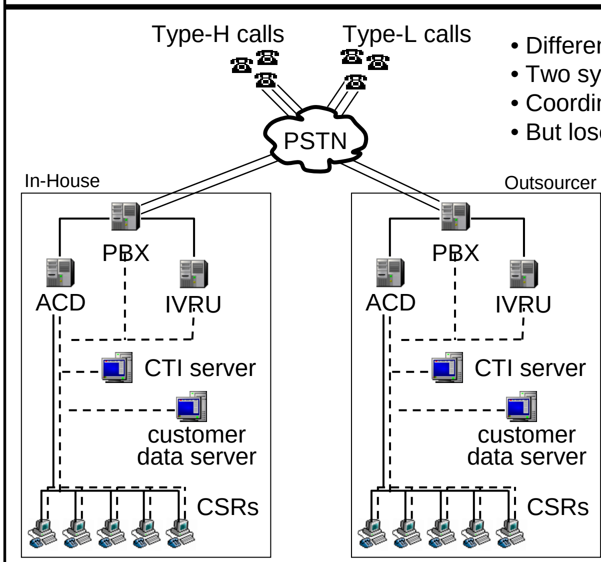


- Infrastructure fancy
- But 60%-80% of total costs HR
- More CSRs means customers wait less
- Capacity management
  - minimize number of CSRs
  - subject to quality-of-service constraint
- Often excess capacity
  - scheduling constraints
  - queueing effects

How are Calls Routed with More than One Center?



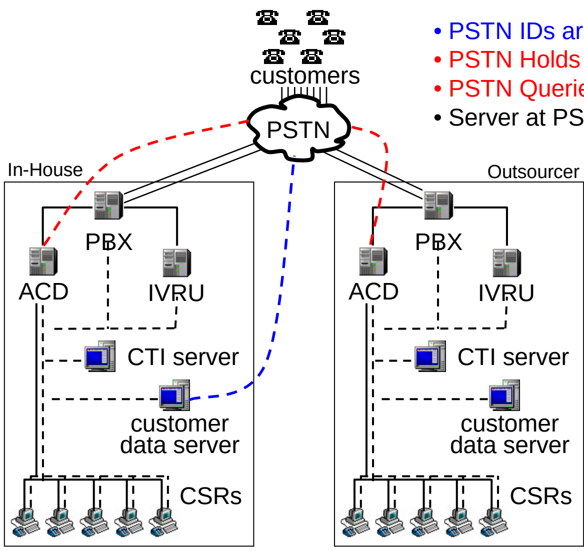
Simplest Case: No Interaction



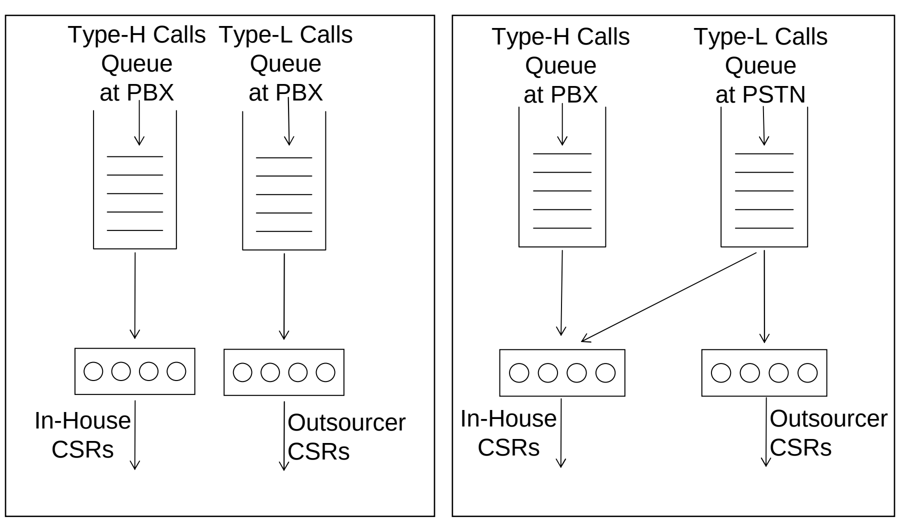
- Different callers dial different numbers
- Two systems managed independently
- Coordination straightforward
- But lose ability to pool capacity

Most Sophisticated: Dynamic Routing of Type-L Calls

- PSTN IDs arriving calls
- PSTN Holds Type-L calls in queue
- PSTN Queries ACDs for Occupancies
- Server at PSTN decides on routing

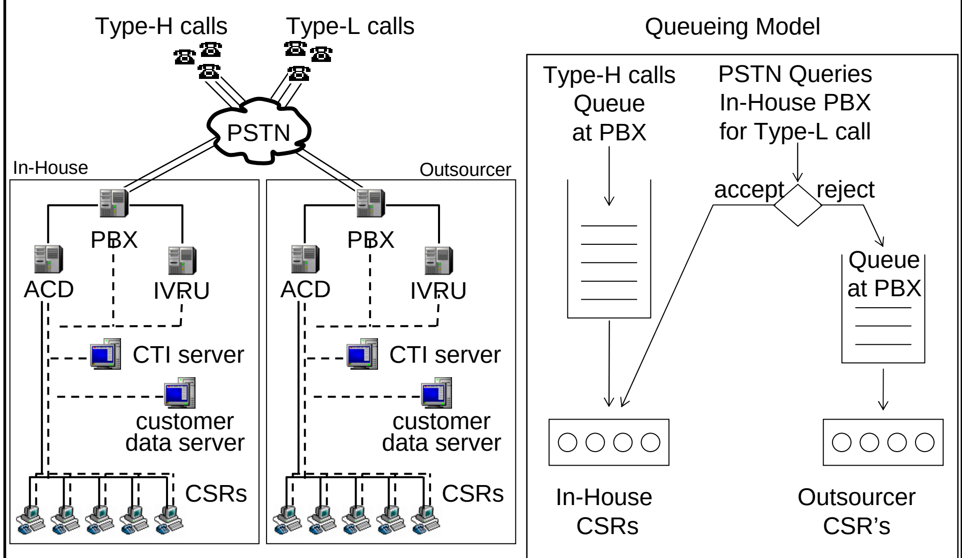


Queueing Models for the Two Systems



Separate Queues "N" Network

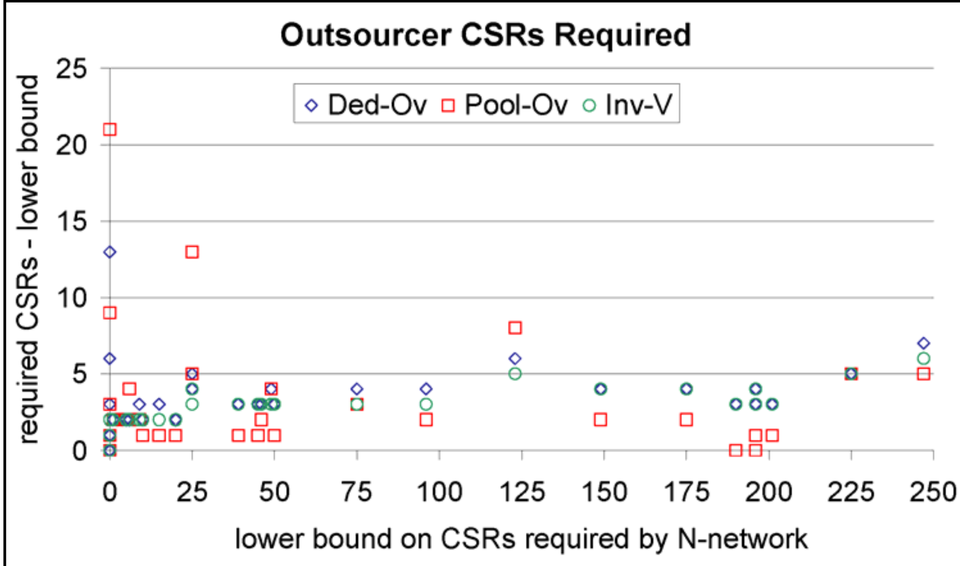
“Overflow” Schemes of Intermediate Complexity



45 examples that compare how the schemes perform

- Each example has fixed demand statistics
  - Service-time distribution same across call types and fixed for all examples
  - Arrival rates very across examples
- Each example has fixed number of in-house CSRs
  - Numbers very across examples
- How many outsourcer CSRs are required by each scheme?
  - Number required to meet type-H and type-L call service-level constraints
  - Given “optimal” operation of each type of scheme
- Caveat: “optimal” routing for N-network not known
  - We derive a lower bound on number of outsourcer CSRs needed by N-network
  - We compare actual numbers needed by other schemes to the lower bound

Small examples: overflow schemes require high % more



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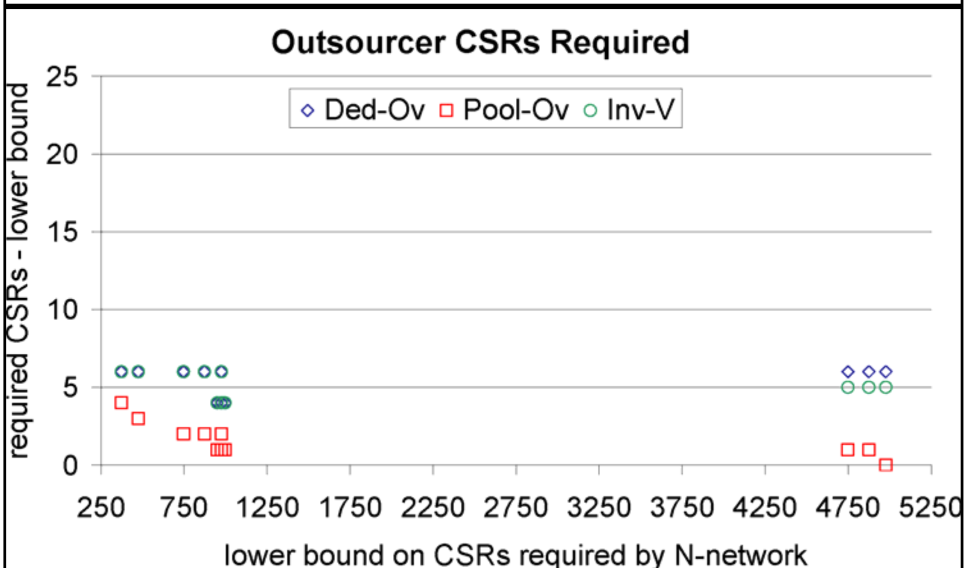
Large examples: pooled-overflow scheme nearly optimal



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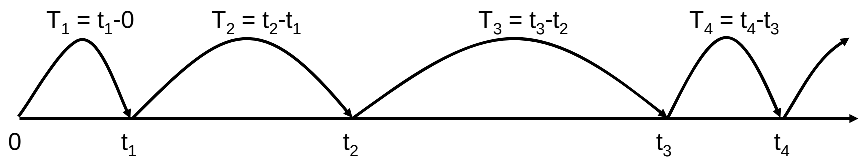
Arrival pattern at outsourcer drives need for extra CSRs

- Times between call arrivals to the outsourcer are a stochastic process



- Coefficient of variation (CV)
  - $CV = \sigma(T_i)/E[T_i]$ = marginal variability of individual inter-arrival times
  - higher in the overflow process
  - easy to account for
- Correlation coefficient (CC)
  - $CC = \rho(T_i, T_{i+1})$ = 1-step serial correlation between pairs arrivals
  - non-zero in the overflow process
  - difficult to account for

We can disentangle the effects of CV and CC

- For each example we can construct a system with
  - same CV of the interarrival time as in the overflow systems
  - zero CC of the interarrival time
  - called an Interrupted Poisson Process (IPP) system
- If CSRs required for the IPP system near that for the overflow system
  - then CV, rather than CC, drives need for extra CSRs
  - relatively simple to determine staffing level required at outsourcer

In fact, the zero-CC (IPP) model explains most variation

Implications for call-center outsourcing

- For larger systems, simpler routing schemes are nearly optimal
  - requires less sophisticated, less expensive infrastructure
  - requires lower level of coordination between client and outsourcer
- CV, rather than CC, of interarrival times appears to drive extra staffing
  - CV is much easier to model than CC
  - easier to monitor and contract on staffing levels
- In large systems results suggest that CSR costs nearly linear in demand
  - capacity (number of CSRs) nearly linear in usage (number of calls)
  - contract on one will yield results that are very similar to those for the other

Follow-on questions

- What can one say about systems where service times vary greatly?
  - across call types
  - across centers
- How do other queueing effects affect the nature of these results?
  - customer abandonment behavior
  - arrival-rate uncertainty