Service Engineering: Data-Based Research and Teaching in support of Service Management

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http://ie.technion.ac.il/serveng

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Background Material (Downloadable)

Technion's **"Service-Engineering" Course** ($\geq$ 1993):
http://ie.technion.ac.il/serveng

Evolution:

- Graduate Research Seminar
- Elective Theoretical course: joint graduate-undergraduate
- Elective Theoretical + Empirical (Data-Based)
- **Compulsory within Industrial-Engineering**:
  attended by $\geq$ 100 **students (I.E. and others) annually**.

Main Messages

1. Simple Useful Models at the Service of **Complex Realities**.

Note: Useful must be Simple; Simple could require **Deep** analysis

2. Data-Based Analysis & Teaching is a Must & Fun.

Supported by **DataMOCCA** = Data **MO**dels for **C**all **C**enter **A**nalysis; Technion + Wharton **research** project, available for (academic) adoption. (eg. 2.5 years, 220M/40M telephone calls, 800 agents)

3. Back to the **Basic-Research Paradigm** (Physics, Biology, . . .): **Measure, Model, Experiment, Validate, Refine, etc.**

4. Yields **scientifically-based design principles and tools (software)**, that support the balance of service **quality**, process **efficiency** and business **profitability**, from the often-conflicting views of **customers, service-providers, managers and society**: **Service Engineering** .

Staffing: How Many? When? What? Who?

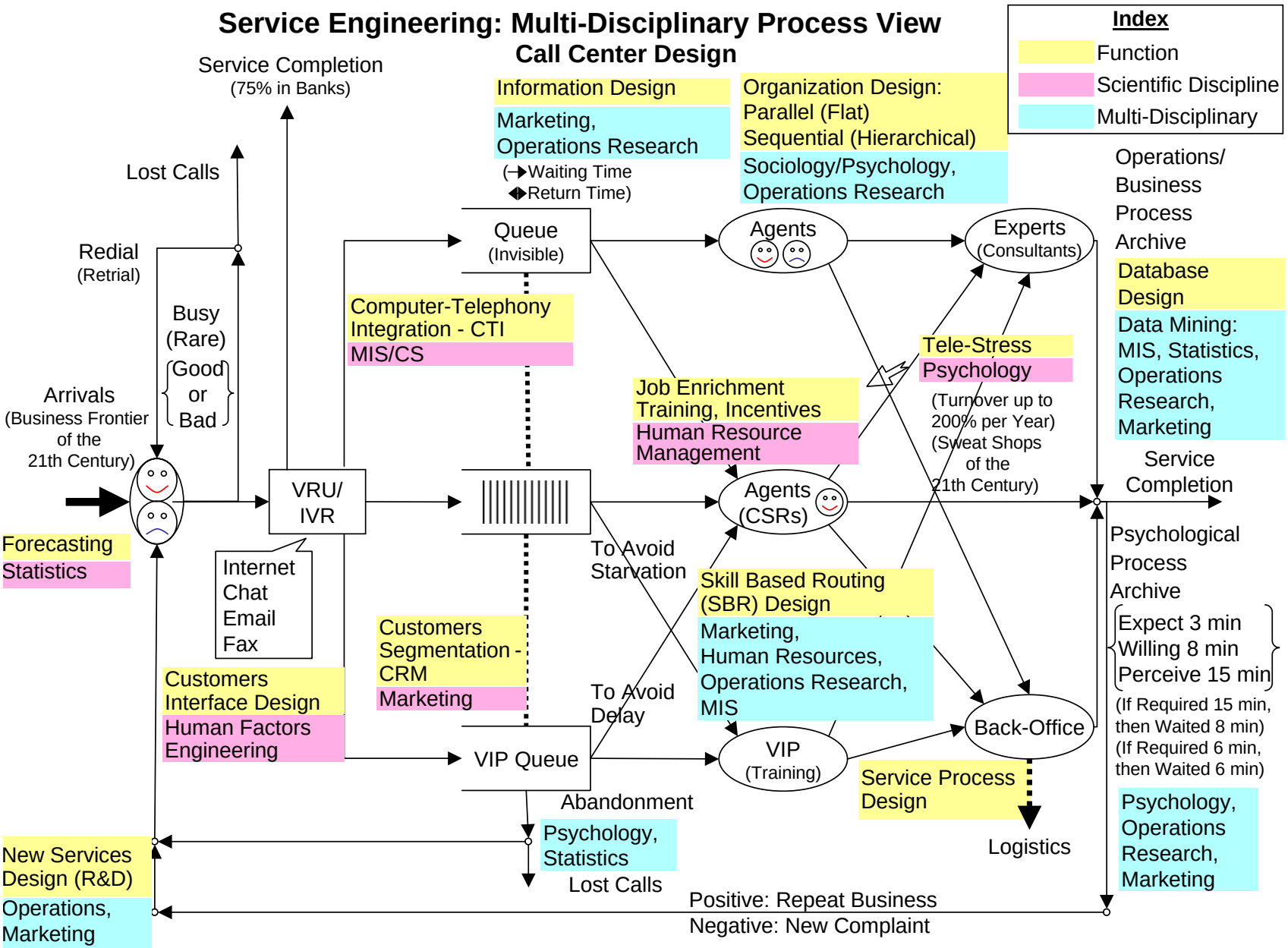
Fundamental challenge in Services: Healthcare, . . . , **Call Centers**

- Reality Complex and becoming more so
- Staffing is based on The Erlang-C (M/M/n) model (1913!)

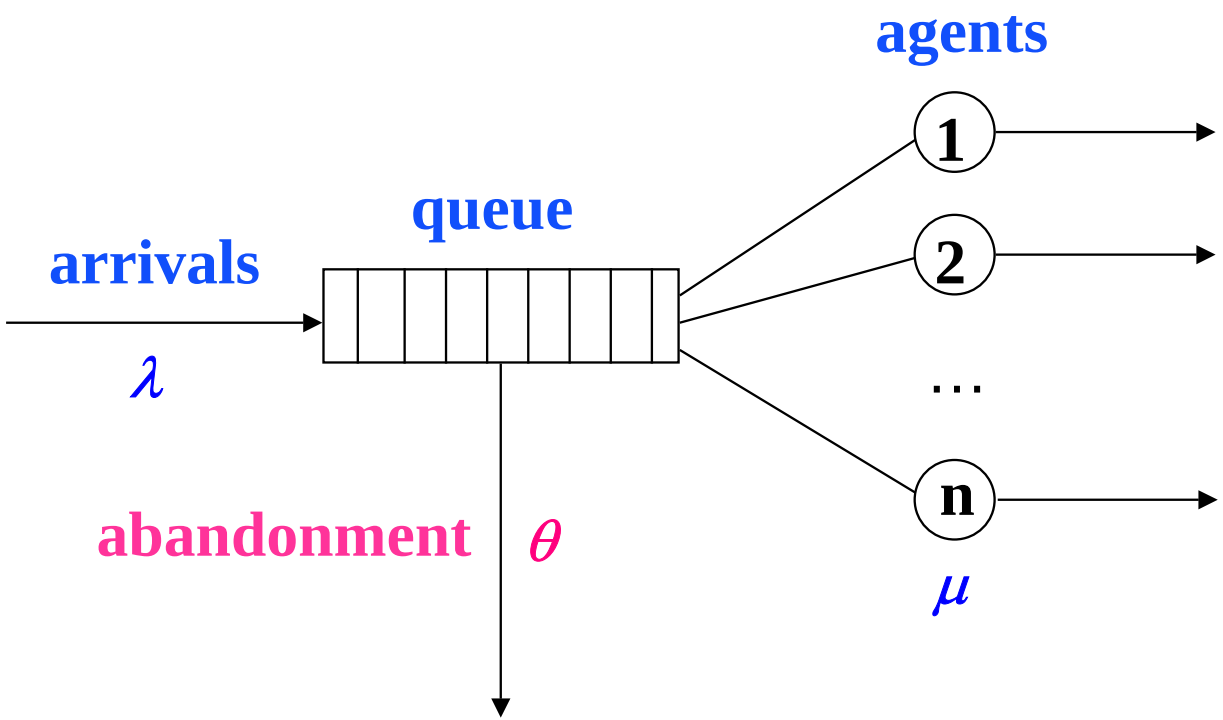
$\Longrightarrow$ Solutions urgently needed.

Consider, for example, **Palm/Erlang-A**: a simple (but not too simple) **Mathematical Model** of the complex reality of call centers.

Complex Reality: Call-Center Network



Simple Model: Palm/Erlang-A

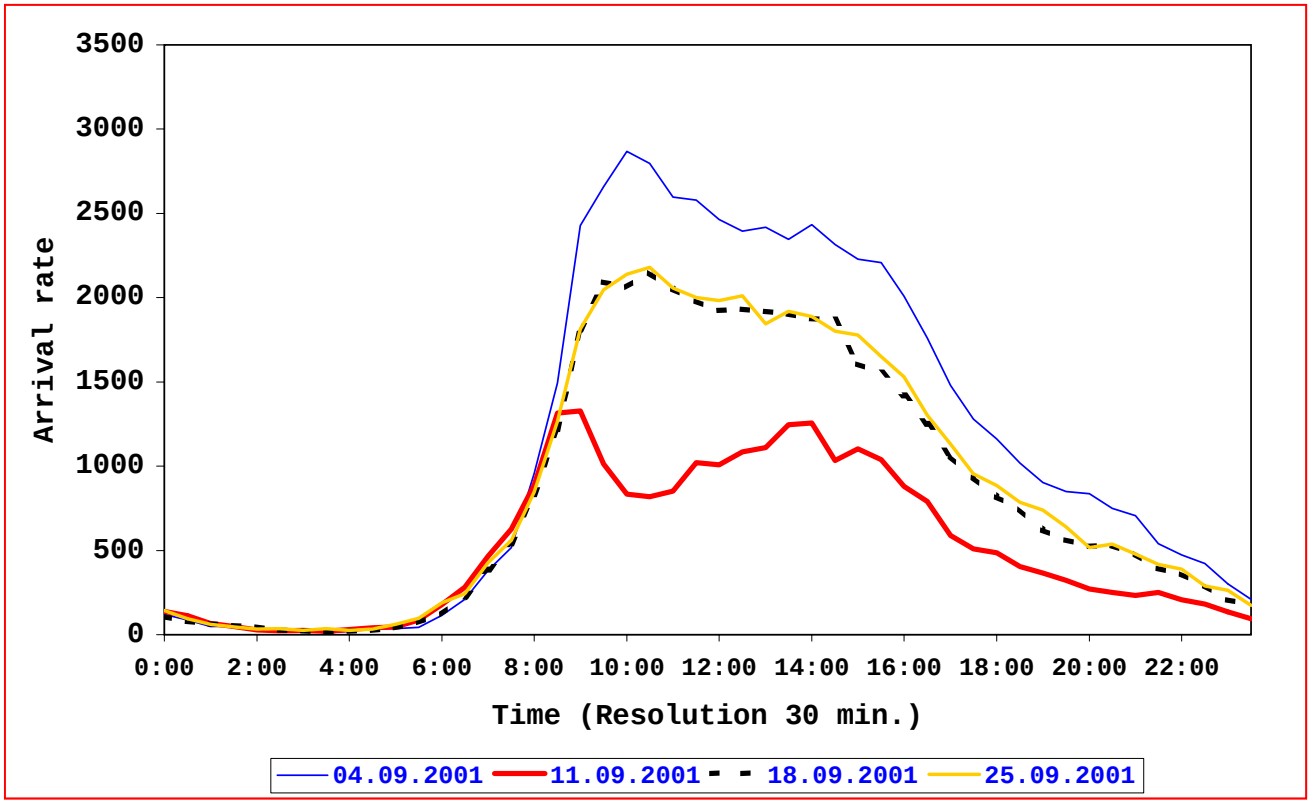


Erlang-A Parameters (Math. Assumptions):

- λ – **Arrival** rate (Poisson)
- μ – **Service** rate (Exponential)
- θ – **Impatience** rate (Exponential)
- n – Number of **Service-Agents**.

Arrivals to Service: Poisson-Relatives

Arrival Rates on Tuesdays in a September – U.S. Bank

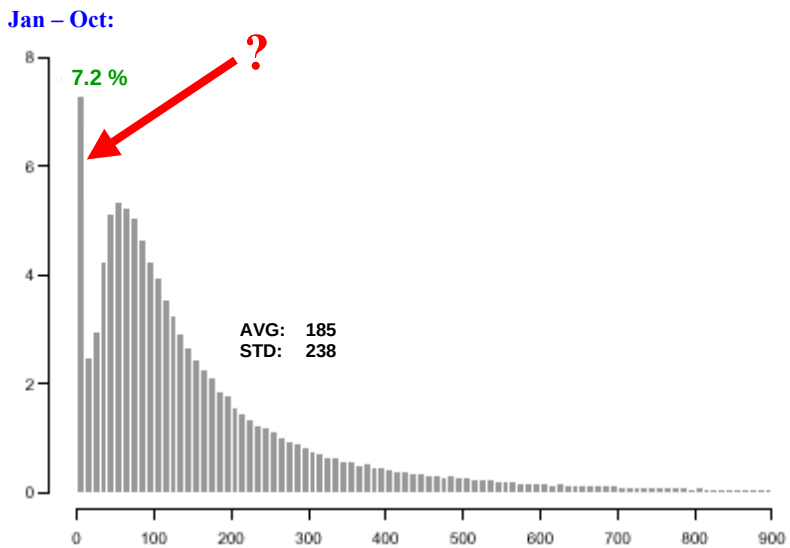


- **Tuesday**, September 4th: **Heavy**, following Labor Day
- **Tuesdays**, September 18 & 25: **Normal**
- **Tuesday, September 11th, 2001.**

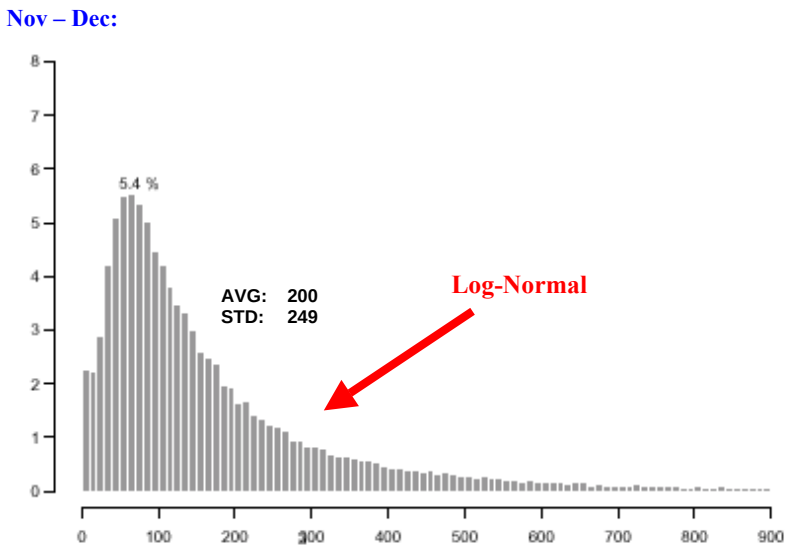
Service Durations: The LogNormal Law

Service Durations in a Typical (?) Call Center

January-October



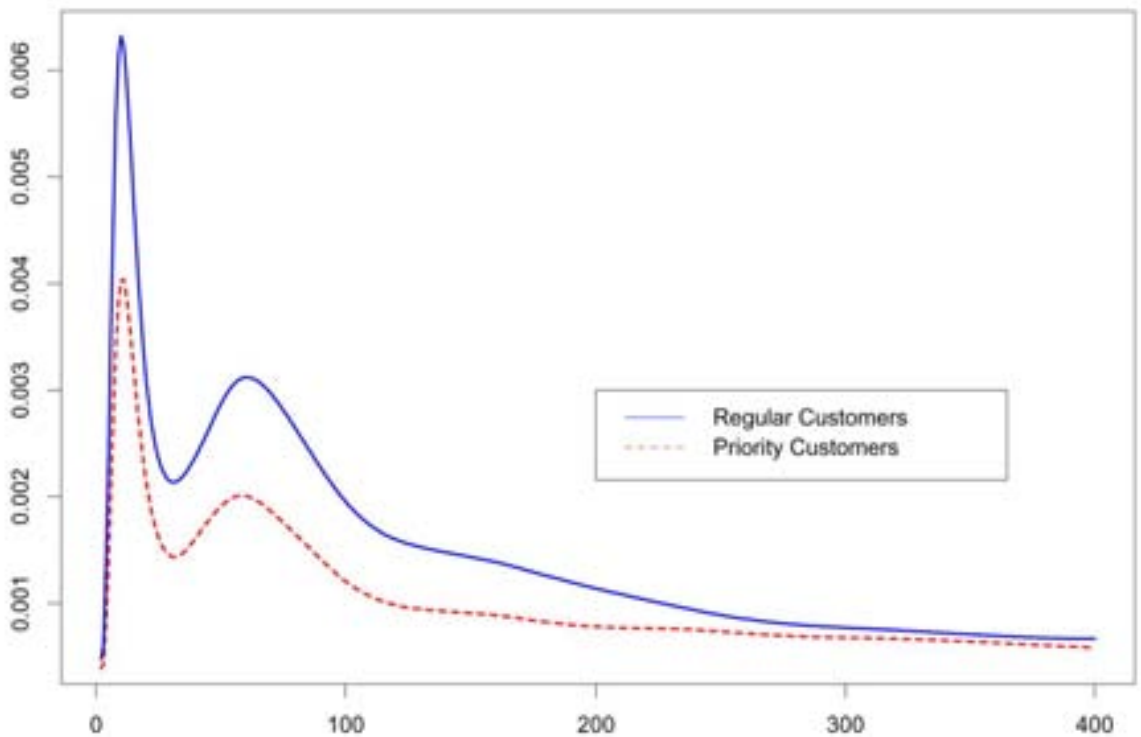
November-December



- **Lognormal** service times prevalent in call centers
- **7.2% Short-Services:** Agents' "Abandon" (improve bonus, rest)
- **Distributions**, not only **Averages**, must be measured.

(Im)Patience While Waiting: Palm's Law of Irritation

Hazard Rates of (Im)Patience – Israeli Bank:
Regular over **VIP** Customers



- **Peaks** of abandonment at times of **Announcements**
- **VIP** are more **Patient** (Needy) than the Others
- **Call-by-Call Data (DataMOCCA)** required (Un-Censoring).

Erlang-A: Simple, Useful, Robust, Insightful, Optimal

- **Simple:** 4CallCenters calculator (download in our Website)

All Palm/Erlang-A assumptions are violated.
Yet the model often fits very well, so much so that the model is

- **Useful:** Replaces Erlang-C as the WFM standard
- **Robust:** QED asymptotics (moderate-to-large systems)
- **Insightful:** Square-Root Staffing rules; E.O.S.
- **Optimal:** Could save significant $'s
- **and Generalizable:** Time-Varying, CRM/SBR, . . .,

Still has its **Limitations**, theoretical & practical, all of which simulates

$\Longrightarrow$ **Current Research**

Back to Main Messages: Summary of Erlang-A

1. **Simple useful** model, requiring and stimulating **deep** analysis.

2. Supported by **Data-Based** research & teaching.
(**DataMOCCA**, available for (academic) adoption.)

3. Takes one back to the **basic-research** paradigm:
Measure, Model, Experiment, Validate, Refine, etc.

4. Generates scientifically-based **design principles, tools (software) and teaching material**, downloadable at the Service-Engineering Course website http://ie.technnion.ac.il/serveng