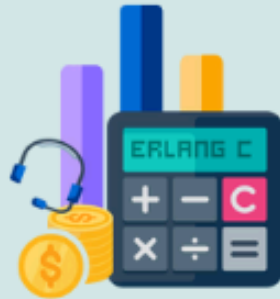


eBook

How to Apply Erlang C in Call Center Planning

The little book that tells you everything you need to know



peopleware



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What is Erlang C?

Erlang C, the mathematical method behind the call center queuing model of the same name, is the tried and tested method for calculating call center staffing requirements for inbound calls. Erlang C takes a given number of incoming calls with a given average handling time (AHT) then calculates the number of staff needed to achieve a given service level, e.g. 80% of calls answered within 20 seconds.

Calculating required staffing is a vital part of the workforce management (WFM) process. Unless you know the number of staff that you will need in each time interval, you won't be able to consistently build shift schedules that match the number of agents with customer demand. Forecasting upcoming call volumes is another important part of the WFM process, but even a super-accurate forecast of the number of incoming calls is useless until it is converted into a required headcount.

History

At the start of the 20th century, telecommunications infrastructure was in its infancy. The technology was very expensive and the newly-founded telephone

companies didn't want to install any more telephone lines (trunks) than absolutely necessary. Since the telephone dial or keypad hadn't been invented yet, every call had to be put through manually by a human 'operator' in a telephone exchange. The companies didn't want to have any more operators on duty than necessary, either - a sentiment that resonates in contact centers to this day.

Enter Agner Krarup Erlang, a Danish mathematician, statistician, and engineer who worked for the Copenhagen Telephone Company in the early 20th century. He invented the fields of traffic engineering and queueing theory. In 1917, he designed methods for calculating the required number of trunks and operators and the eponymous algorithms that he developed are still the basis for determining the required number of agents to meet a forecasted demand in contact centers to this day.

What about A and B?

Erlang A

Erlang A is used to calculate the number of calls that will be abandoned. It assumes an Average Patience (AP) - also known as Average Time to Abandon (ATA).

This is useful information but it doesn't help with staffing calculation.

Erlang B

Erlang B is used to determine how many phone lines (trunks) will be needed simultaneously to handle a given volume of calls and AHT. Again, this is interesting information but not relevant for staffing calculation.

Limitations of Erlang C

Erlang C has been used to calculate required staffing for telephone operators and call center agents for over 100 years. It has passed the test of time, but it does, however, have some limitations. It is built upon a simplified call center traffic model:

- It assumes that callers are infinitely patient and never abandon. It's good practice to forecast and calculate staffing based on the number of offered calls, including those that abandon. If you forecast based on answered calls, you will not take into account the actual customer

demand, which includes those callers who abandon. Since Erlang assumes that callers are infinitely patient and every offered call becomes a handled call, it tends to overestimate the number of agents needed.

- It assumes that calls arrive according to the Poisson distribution. It's beyond the scope of this eBook to delve into statistics and queuing theory, but suffice it to say that the Poisson distribution assumes that the average rate at which random events, e.g. call arrivals, occur is independent of other occurrences. There are cases where this is not true. Sudden 'spikes' of calls sometimes occur because of a single cause, e.g. a flight cancellation or a news announcement.
- It is valid only for inbound phone calls. It doesn't accurately model digital channels or other asynchronous contacts. Abandoning contacts such as web chats do behave similarly to phone calls, but because agents typically handle more than one chat concurrently, Erlang C can only be

used in a modified form. The other channels need a different calculation method entirely.

How to use Erlang C

Even today's workforce management (WFM) systems include Erlang C in their library of staffing calculation methods. With WFM software, using Erlang C is simply a case of selecting it as the calculation method for appropriate workload queues.

If you don't have a WFM system, you can still access Erlang C using a spreadsheet.

Here's the Erlang C formula that the Erlang algorithm uses to find the required headcount.

$$p(>0) = \frac{\frac{A^N}{N!} \left(\frac{N}{N-A}\right)}{\sum_{x=0}^{N-1} \frac{A^x}{N!} + \frac{A^N}{N!} \left(\frac{N}{N-A}\right)}$$

Where:

A=total traffic (in Erlang c)

N=number of resources

$P(>0)$ = probability of delay

P=probability of loss Poisson formula

It looks a bit scary, doesn't it? The good news is that you don't need to be both a workforce planner and a math professor to successfully use Erlang C. This is where Erlang calculators are your friend. Excel-based 'Erlang calculators' are popular because they're cheap and simple to set up. A quick Google search will reveal several online Erlang calculator tools - many free to use. These range from mobile apps that can do on-the-fly Erlang C calculations, all the way to complete Excel spreadsheet solutions at the other end of the spectrum.



[Check out the Peopleware free online Erlang C calculator. It lets you use copy/paste to calculate staffing requirements for an entire day in one go.](#)

Conclusion

Erlang C is still the go-to method for calculating the number of agents needed to handle incoming phone calls. It has its limitations, but once you are aware of them, you'll be able to make fully effective use of it.

Excel-based Erlang calculators are a handy solution and typically there's no need to spend money to get hold of one. They do however come with risky drawbacks. Excel spreadsheets don't take care of automatically importing contact history. They don't enable the sort of accuracy that AI-based WFM software unlocks. What's more, manual maintenance and outdated user interfaces sooner or later become pains that cause workforce planners to realize that Excel spreadsheets are merely a short-term solution.

Still using spreadsheets?

[Check out the blog post 8 signs you've outgrown Excel.](#)

About Peopleware

Peopleware is the award-winning, multi-channel cloud workforce management application for contact centers and customer support. Over 300 customers, ranging in size from 50 to over 4,000 seats, trust Peopleware to bring work and demand in perfect balance while embracing the constant change in their business. With peopleware, you spend less time and effort on manual forecasting and scheduling, while maximizing efficiency and focusing on what really matters: your people and customers.

We have a team of highly experienced experts who are passionate about WFM and the transformation that it can bring about. Many members of our team are former planners. They have walked in your shoes and they speak your language. When it comes to implementing the Peopleware WFM software, we measure ourselves by your success and we never recommend Peopleware WFM unless it will really help you achieve your goals and overcome your challenges. If you've read enough about WFM to know that it's worth investigating, why not [arrange a no-obligation call with us?](#)



Want to see how Peopleware makes the workforce management process a breeze?

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Contact

www.peopleware.com

info@peopleware.com

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