Contents

Terms Used

common languages typical languages programmers use to write commercial software, (e.g., C, C++, Java, Javascript, Python, Ruby, Go, Perl, PHP, etc.). 13

pwn The act of dominating a person, place, or thing. (...or a piece of code). 29

scat the excrement of an animal including but not limited to human; also heroin. 7

Technical Terms Used

contexts A set of key value pairings that serve as a data payload attributable to nodes and edges in Jaseci graphs. 15

directed graphs . 14

hypergraph . 14

multigraph . 14

undirected graphs . 14

Preface

The way we design and write software to do computation and AI today sucks. It's a vat of boiling poop, mixed with pee, slowly swirling and bubbling toward that dehydrated semi-solid state of goop that serves to repel and repulse most normal people only attracting the few unfortunate-fortunate folks that happen to be obsessed with scat.

Hrm, too much? Probably. I guess you'd expect me to use concrete examples and cite evidence to make my points, me being a professor and all. I mean, I could write something like *"The fundamental imperative programming model utilized in near all of the production software produced in the last four decades has not changed since blah blah blah..."* to meet expections. I'd certainly sound more credible and perhaps super smart. Well, I'm not going to do that here. Let's have fun. Afterall, Jaseci has never been work for me, its play. Very ambitious play granted, but play at it's core.

Everything here is based on my opinion and intution. That suffices for me, and I hope it does for you. I have spent many decades coding and leading teams who code, but its my gut that tells me that we can do better. This book describes my attempt at better. I hope you find value in it. If you do, awesome! If you don't, also awesome.

Chapter 1

Introduction

Chapter 2

What and Why is Jaseci?

2.1 Viewing the Problem Landscape Spacially

2.2 Compute via The Collective, The Worker Bee Model

Chapter 3

Abstrations of Jaseci

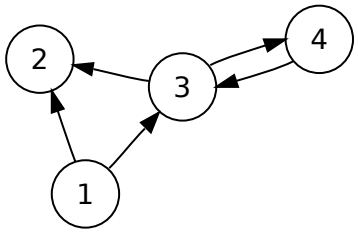
3.1 Graphs, the Friend that Never Gets Invited to the Party

There's something quite strange that has happend with our common languages over the years, ...decades. When you look at it, almost every data structure we programmers use to solve problems can be modeled formally as a graph, or a special case of a graph, (save perhaps hash tables). Think about it, stacks, lists, queues, trees, heaps, and yes, even graphs, can be modeled with graphs. But, low and behold, no common language ustilizes the formal semantics of a graph as its first order abstraction for data or memory. I mean, isn't it a bit odd that practically every data structure covered in the language-agnostic classic foundational work *Introduction to Algorithms* [3] can most naturally be be reasoned about as a graph, yet none of the common languages have built in and be designed around this primitive. I submit that the graph semantic is stupidly rich, very nice for us humans to reason about, and, most importantly for the purpose of Jaseci, is inherently well suited for the conceptualization and reasoning about computational problems.

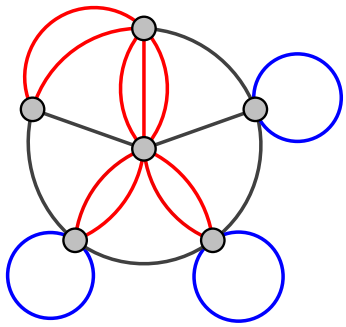
There are a few arguments that may pop into mind at this point of my conjecture.

- "Well there are graph libraries in my favorite language that implement graph symantics, why would I need a language to force the concept upon me?" or
- "Duh! Interacting with all data and memory through graphical abstractions will make the language sslloooowww as hell since memory in hardware is essitially a big array, what is this dude talking about!?!?"

For the former of these two challenges, I counter with two points. First, the core design of a language are always based upon its inherent abstractions,



(a) Directed graph with cycle between nodes three and four.



(b) Multigraph with parallel edges and self-loops

Figure 3.1: Examples of first order graph symantics supported by Jaseci. (Images credits to wiki contributors [1, 2])

and with graphs not being one such abstraction the language's design will not be optimized to empower programmers to nimbly do gymnastics with the rich symantics that graphs offer. And second, libraries suck (See A.1).

For the latter question, I'd respond, "Have you SEEN the kind of abstractions in modern languages!?!? It's rediculous, lets look at python dictionaries, actually scratch that, lets keep it simple and look at dynamic typing in general. The runtime complexity to support dynamic typing is most certainly hgiher than what would be needed to support graph symantics. Duh right back at'ya!"

3.1.1 Yes, But What Kind of Graphs

There are many categories of graphs to consider when thinking about the abstractions to support in Jaseci. There are rules to be defined as to the availabe semantics of the graphs. Should all graphs be directed graphs, should we allow the creation of undirected graphs, what about parallel edges or multigraph, are those explicitly expressible or discouraged / banned, can we express hypergraph, and what combination of these graphical sematics should be able to be manifested and manipulated through the programming model. At this point I can feel your eyes getting droopy and your mind moving into that intermediary state between concious and sleeping, so let me cut to the answer.

In Jaseci, we elect to assume the following semantics:

1. Graphs are directed (as per Figure 3.1a) with a special case of a doubly directed edge type which can be utilized practically as an undirected edge (imagine fusing the two edges between nodes 3 and 4 in the figure).

2. Both nodes and edges have their own distinct identities (i,e. an edge isn't representable as a pairing of two nodes). This point is important as both nodes and edges can have contexts.
3. Multigraphs (i.e., parallel edges) are allowed, including self-loop edges (as per Figure 3.1b).
4. Graphs are not required to be acyclic.
5. No hypergraphs, as I wouldn't want Jaseci programmers heads to explode.

As an aside, I would describe Jaseci graphs as strictly unstrict directed multigraphs that leverages the semantics of parallel edges to create a laymans 'undirected edge' by shorthanding two directed edges pointed in opposite directions between the same two nodes.

[START NERD ALERT] I'd formally describe a Jaseci Graph as an 7-tuple $(N, E, C, s, t, c_N, c_E)$, where

1. N is the set of nodes in a graph
2. E is the set of edges in a graph
3. C is the set of all contexts
4. s: $E \to V$, maps the source node to an edge
5. t: $E \to V$, maps the target node to an edge
6. c_N: $N \to C$, maps nodes to contexts
7. c_E: $E \to C$, maps edges to contexts

An undriected edge can then be formed with a pair of edges (x, y) if three conditions are met,

1. $x, y \in E$
2. $s(x) = t(y)$, and $s(y) = t(x)$
3. $c_E(x) = c_E(y)$

[END NERD ALERT]

If you happend to have read that formal definition and didn't enter deep comatose you may be wondering "Whoa, what was that context stuff that came outta nowhere! What's this guy trying to do here, sneaking a new concept in as if it was already introduced and described."

Worry not friend, lets discuss.

3.1.2 Putting it All Into Context

A key principle of Jaseci is to reshape and reimagine how we view data and memory. We do so by fusing the concept of data wit the intuitive and rich semantics of graphs as the lowest level primitive to view memory.

A context is a representation of data that can be expressed simply as a 3-tuple $(\sum_K, \sum_V, p_K)$, where

1. $\sum_K$ is a finite alphabet of keys
2. $\sum_V$ is a finite alphabet of values
3. p_K is the pairing of keys to values

3.2 Walkers

3.3 Abilities

3.4 Other Abstractions Not Yet Actualized

Chapter 4

Architecture of Jaseci and Jac

4.1 Anatomy of a Jaseci Application

4.2 The Jaseci Machine

4.2.1 Machine Core

4.2.2 Jaseci Cloud Server

Chapter 5

Interfacing a Jaseci Machine

5.1 JSCTL: The Jaseci Command Line Interface

5.2 Jaseci Rest API

Chapter 6

The Jac Programming Language

Chapter 7

Architecting Jaseci Core

Chapter 8

Architecting Jaseci Cloud Serving

Epilogue

Appendix A

Rants

A.1 Why Libraries Suck

Because they do.

Still need more reasons?

Well, if you dont already know, I'm not going to tell you.

Fine, I'll tell you.

1. They suck because they create dependancies for which you must have faith in the implementer of the library to maintain and keep bug free.
2. They suck because there are often at least 10 options to choose from with near exact features expressings slightly different idosyncratic ways.
3. They suck because they suck.

Don't get me wrong, we have to use libraries. I'm not saying go reimplement the wheel 15 thousand times over. But that doesn't mean they don't suck and should be avoided if possible. The best is to know your library inside and out so the moment you hit some suckitude you can pull in the library's source code into your own codebase and pwn it as your own.

Bibliography

[1] Wikimedia Commons. File:directed graph no background.svg — wikimedia commons, the free media repository, 2020. [Online; accessed 13-July-2021].

[2] Wikimedia Commons. File:multi-pseudograph.svg — wikimedia commons, the free media repository, 2020. [Online; accessed 9-July-2021].

[3] Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, and Clifford Stein. *Introduction to Algorithms, 3rd Edition.* MIT Press, 2009.