

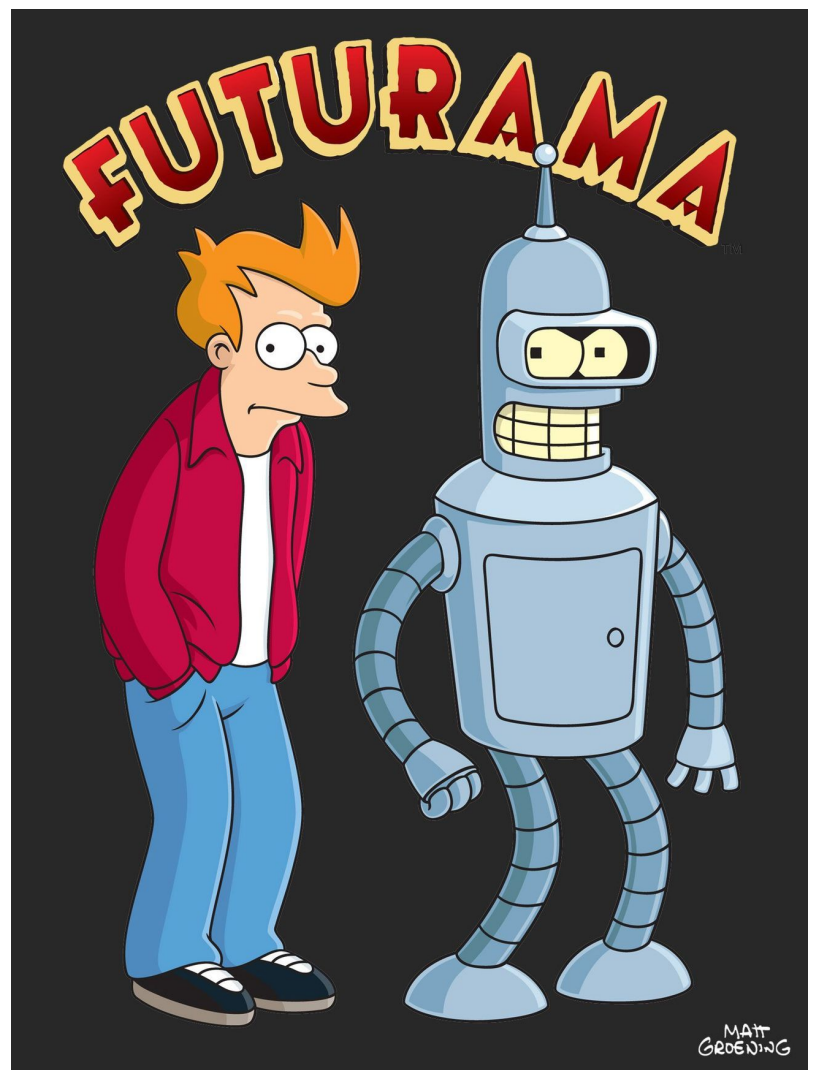
The Future of the Edge

Ian Wells

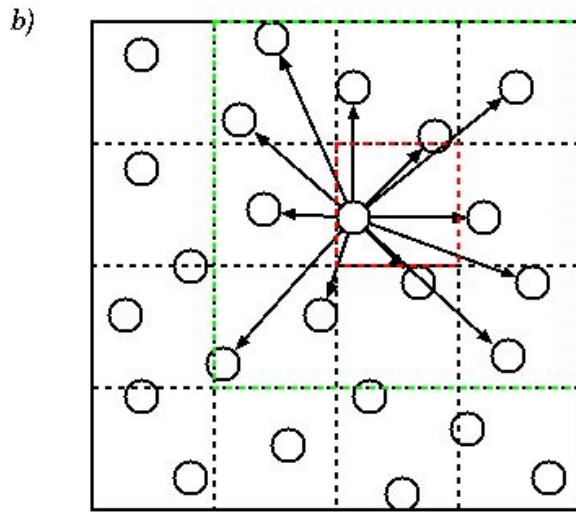
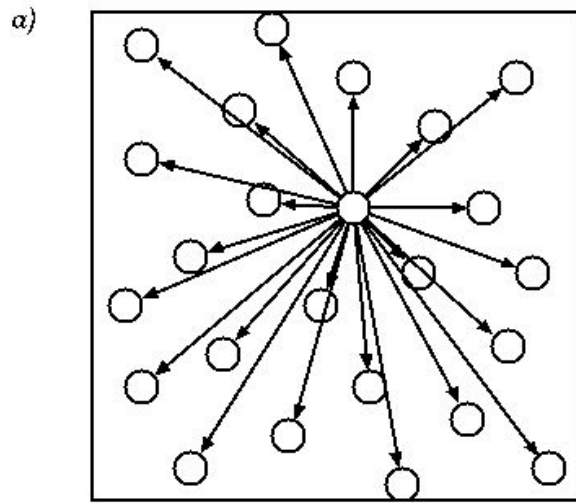
Distinguished Engineer, Cisco

Kyle Mestery

Distinguished Engineer, Cisco



What Is Edge Computing?



Is It Computing In Edge?



Is It Computing on the Edge?



Is It Edge, Computing?



https://commons.wikimedia.org/wiki/File:Bono_Edge_Foxboro_09212009_U2360.jpg

The Edge You
Need to Worry
About

Your ops team



← Your architects

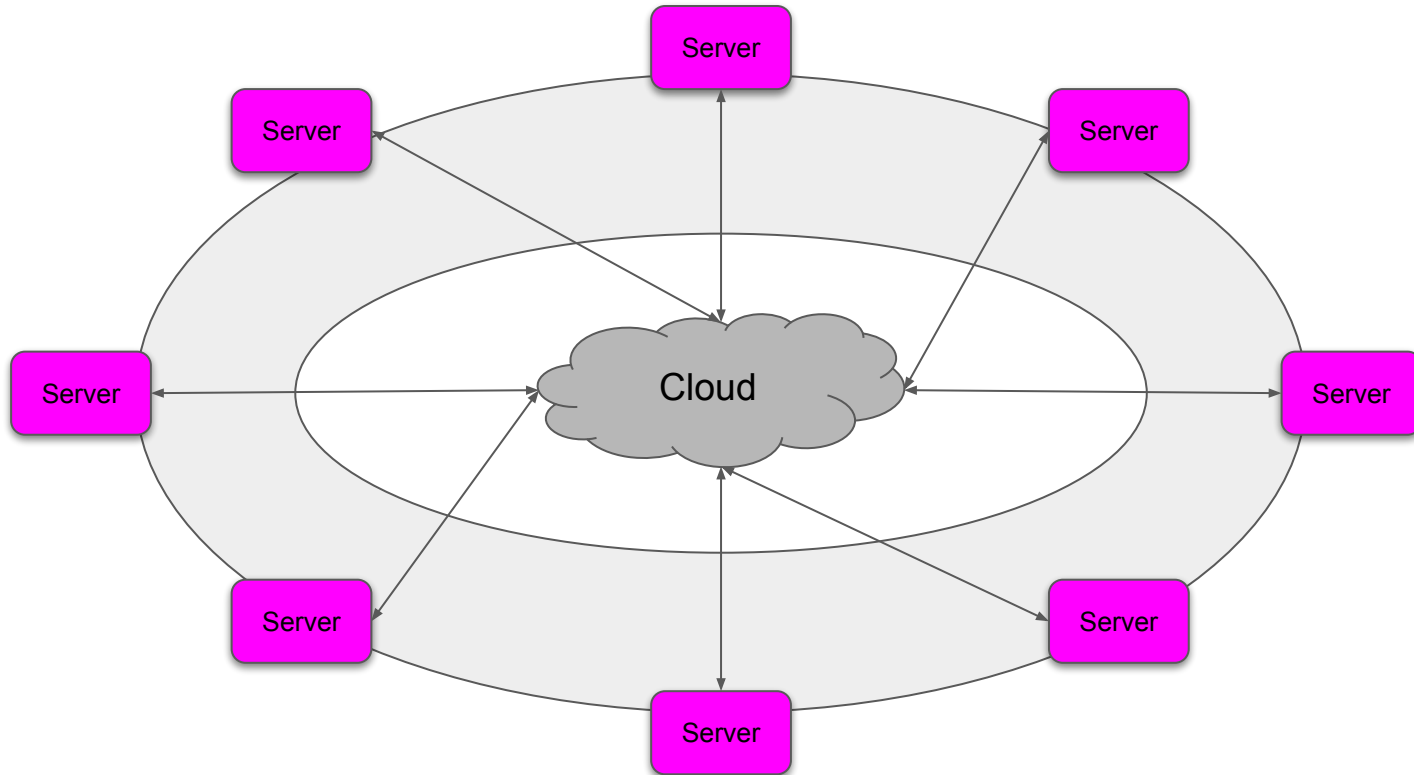
We're Using the Broadest Definition Possible

General purpose computing

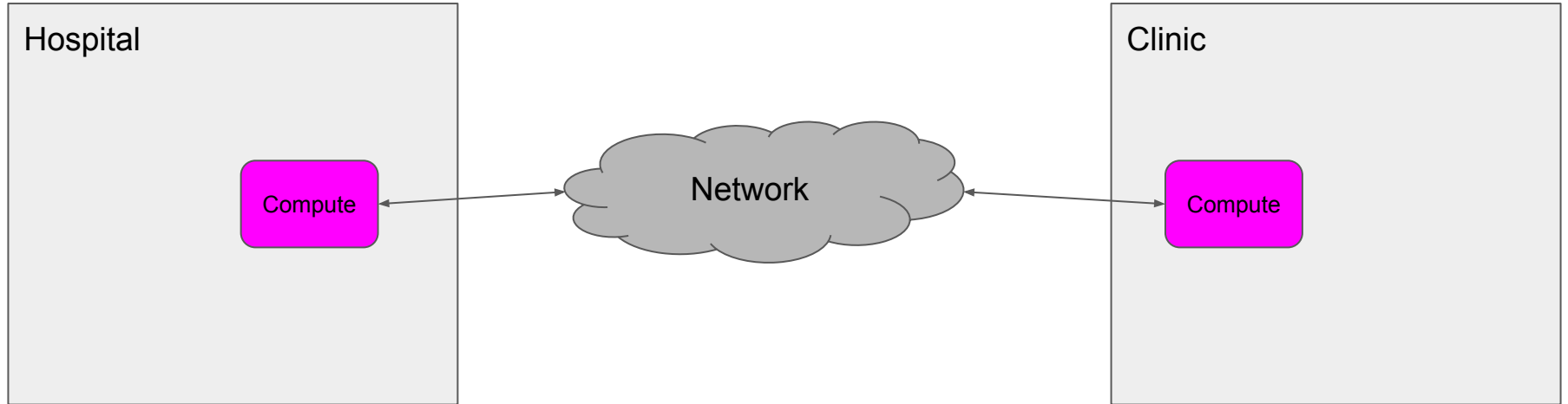
- .. put in the location best suited to it
- .. at arm's length
- .. under tenuous control
 - No guarantee of qualified staffing locally
 - Not necessarily on a site your company owns or can physically access

The details of the compute platform don't matter - there are plenty of problems to worry about aside from 'are we using containers?'

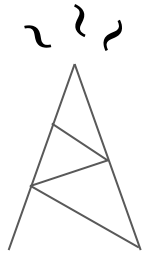
“Cloud to Edge” Computing



Healthcare Edge Computing

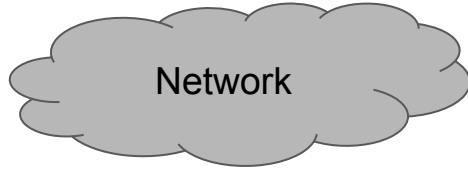


MNO Distributed Computing



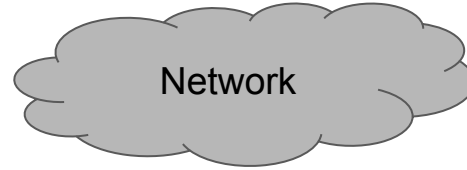
Compute

RAN
1000-10000 sites



Compute

Region/Peering
10-100 sites



Compute

Core/OSS
2-10 sites

Trusty Wikipedia Definition

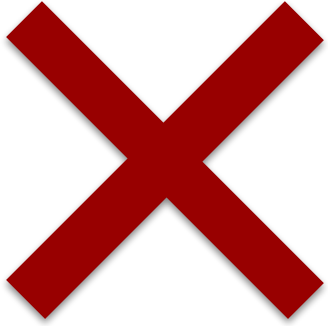
From [Wikipedia](#):

*It is a **distributed computing** paradigm in which computation is largely or completely performed on distributed device **nodes**. **Edge computing pushes applications, data and computing power (services)** away from centralized points to locations closer to the user.*

*The target of edge computing is any application or general functionality needing to be closer to the source of the action where distributed systems technology **interacts with the physical world**. Edge computing does not need contact with any centralized cloud, although it may interact with one.*

The Main Drivers of Edge Computing

The Main Drivers of Edge Computing





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FOR ALL DEBTS, PUBLIC AND PRIVATE

Mary Ellen Withrow
Treasurer of the United States.

100

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Scottsdale Cabral
Treasurer of the United States.

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93 A

How Can Edge Computing Make Me Money?

I can do things I couldn't do before (and for that people pay me more money):

- Keep software close to the end user and responsive
- Keep software close to a controlled system
- Keep private, secure data close



How Can Edge Computing Save Me Money?

I can do things more cheaply than before:

- Reduce network cost by minimising uplink bandwidth
- Put right-sized compute exactly where it's needed
- Change my mind about what I do in 10,000 sites without 10,000 truck rolls



Open Source Edge Computing Projects

Edge projects ... *Some* Edge Projects ...



EDGE X FOUNDRY™



KubeEdge



This reminds me of something ...

The Wild West: Open Source Networking



Open Source Routing
A Project of The Network Device Education Foundation

Some Things Never Change



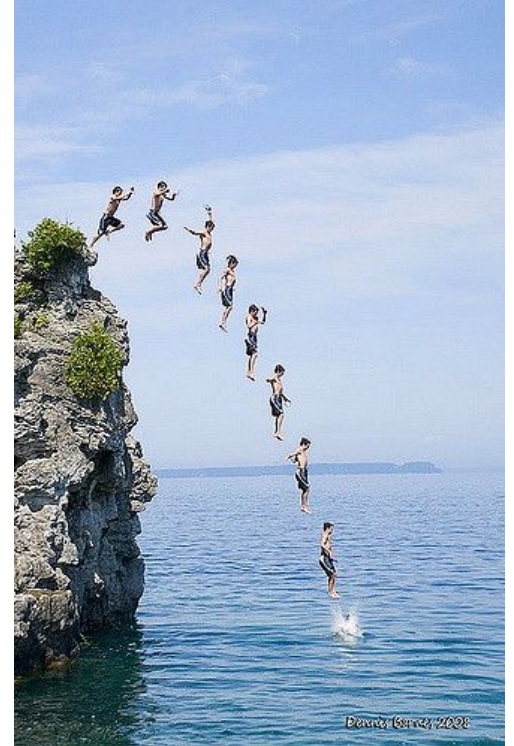
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How Do We Get to the Bottom Of Edge?

Imagine we've solved all our problems

What were the problems?

What was the solution?



How Do We Get to the Bottom Of Edge?

There are other ways to get to the bottom...



Join Us As We Time Travel ...

TO THE FUTURE OF THE EDGE





EDGE COMPUTING:

5 YEARS LATER

Edge Computing Problems
WEHAVESOLVED

In five years' time, edge...

- .. is solving lots of problems in the mobility space, and is cost-effective to operate
- .. is used in branch offices and franchises across the country to centralise IT management for point-of-sales and inventory tasks
- .. keeps sensitive data on hospital sites
- .. deals with local IoT management in manufacturing sites
- .. is ubiquitously deployed around the globe
- .. is developed in less than 25 open source projects and does not involve choosing a standard from a wide variety of standards bodies' opinions

Edge Computing Deployments

- Edge computing is deployed ubiquitously around the globe
 - Retail stores: point of sale, inventory, ...
 - Hospitals and clinics: local secure data, critical systems kept locally
 - Remote manufacturing sites: IoT and automation management
 - Hotels
 - Single and multi-family housing
 - ...

Edge Computing In Open Source

IN THE FUTURE:

- Primary edge computing work is not being duplicated across open source projects
- Commoditization at the lower layers has resulted in providing the capability for innovation at the higher layer



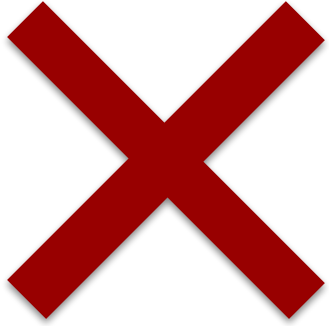
And to do this, we solved a bunch of problems

The ones we thought mattered

What actually mattered a whole bunch more

The Main Edge Computing Problems

The Main Edge Computing Problems



M O N E Y



Why Edge Computing Costs Too Much

- Each individual hardware cost multiplies up by thousands
- I can't afford to expand my ops team by a factor of 10,000
- I have lots of pieces of hardware and no technicians anywhere nearby
- Lots of servers means failures every day, thousands of miles apart

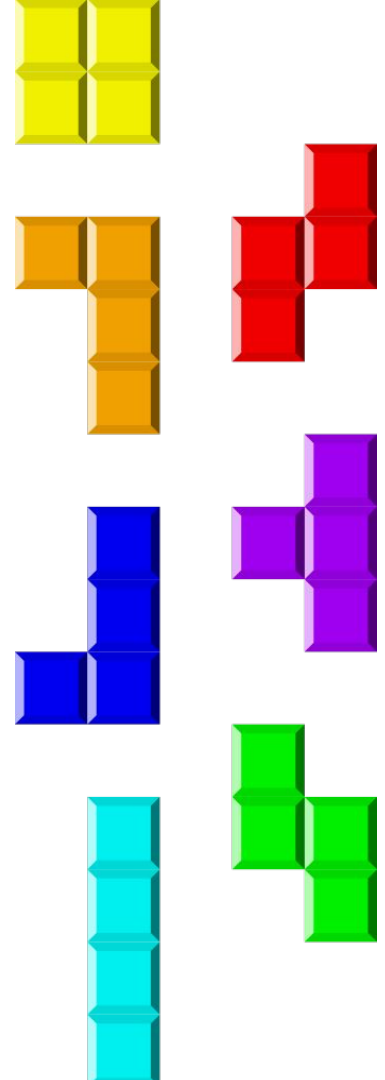


Edge Computing Design Philosophy

- Single points of failure are bad
 - Single points of failure are much worse when they take out all your sites simultaneously
 - ... so those sites have to be autonomous and independent
- But “failure” is not what you think it is
 - “It is not working” does not mean “I am losing money”
 - If the service goes on, and you’re still making money (or you’re losing less money than a higher SLA would cost) then everything is fine
- *But*, management should be central
 - You want one team managing all of your network
 - You don’t want that team to be everywhere simultaneously, because big teams cost money

Design For Efficiency

- Clouds are infinite ... Budgets are not
- The more work you can pack into a piece of compute, the more you can get done with less cash
- Cloud scheduling does not cater well for this today



Day One Deployment Problems

- Note: *these are the least valuable, because I do them once*
- Zero touch on software
 - Why? Because humans are human
 - Where from? Your IT staff will not be on-site, so this has to be centrally controlled
 - If you have no deployment consistency, every site is a snowflake with special behaviour
- One platform description file
- Hardware: trust but verify
 - Humans are also incapable of reading labels



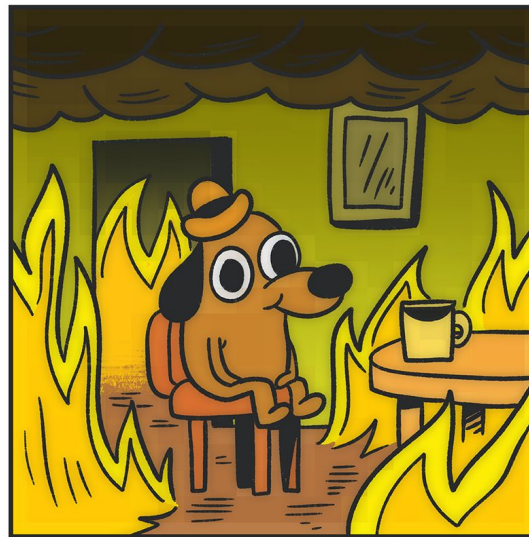
Day Two Management Problems

- Note: *these will happen every day and consume your ops team's life*
- Repair
 - 10,000 locations = *100% chance of failure on any given day*
 - You need roving bands of technicians, but it won't always be your top talent



When Chaos Strikes...

- Problems
 - Software problems *obviously* never happen
 - You need to know whose fault a problem is - and who to blame - to get a quick resolution
 - Problems you can't assign remain *your* problem
 - Is it in the platform? Which app?
- Monitoring and logging have to be integrated up and down the stack, *including hardware*



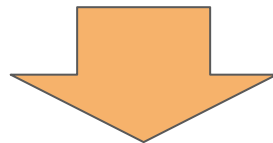
Targeting Workload to the Correct Edge

- It's *always* a scheduling problem
- Workload placement becomes critical
- The real value of edge computing is realized by solving this problem
 - This problem might be completely trivial: the same apps at every edge
 - This problem might be immensely complex: apps following customers around the country
 - *Know which one you have*



Consistency of Deployment

- Version consistency is *absolutely key*
 - One version for the platform
 - Control over that version - we can't pull today's freshest component of X every time we make the platform
 - Control over version changes - one line fixes should be expected and catered for
- Continuous integration and deployment
- Best practices from other industries apply



Upgrade In Service

- Cattle not pets
 - *Yeah, right*
- Versioning is important
- Did someone say rolling?
- The SLA is king
 - Retail: 12 hour maintenance windows overnight may be fine
 - Mobile packet core: 2 minute outages have a measurable cost
 - **99.999% (“five nines”) is 5.26 minutes of downtime per year**
 - **... OF THE SERVICE**



Remote Deployment

- You can't always physically be at edge sites
 - Security reasons
 - Physical location (e.g. it's remote)
 - Sheer number of edge sites
- You can't assume that you'll have an onsite presence for any management operation
- You can't replace physical equipment without an onsite presence
 - How long can you go without replacing a dead server? - This is what redundancy gets you, but redundancy costs money



Edge Security

- Have you heard of IoT security problems?
 - *Let's avoid similar problems with edge computing*
- Without security the promise of edge computing disappears



Operational Cost Management of the Edge

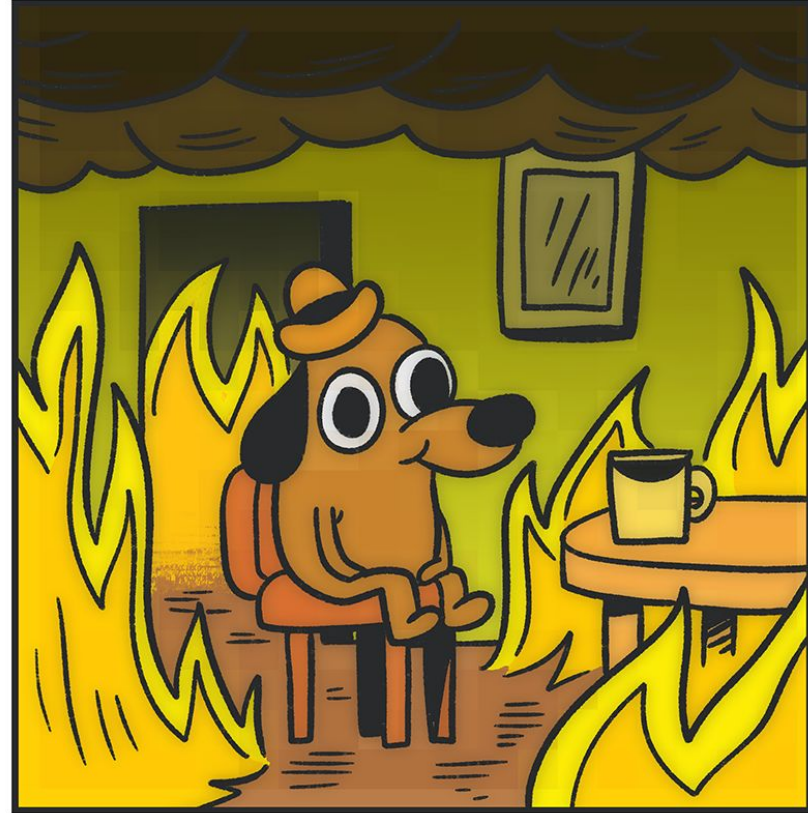
- De-skilling onsite ops: truck rolls, not experts
- Fewer reports to operators: fewer failures and better analysis of problems
- Single point management for the entire edge

Concentrate your experts on one team



Failure Scenarios

- The entire Edge cannot fail at once
 - Parts of the edge can fail but there are consequences
- Backup edges?
 - 1:1 was great once, but we're into m:n nowadays
 - ... *because MONEY*





Thank you!