

facebook



# Dr. NMS

## or: How Facebook Learned to Stop Worrying and Love the Network

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Jose

David





**facebook**  
INFRASTRUCTURE

# ZERO IMPACT NETWORK



# We'll be talking about



**Facebook scale**



**FDN**



**Tales from  
the real world**



**This journey  
is 1% finished**



**Q&A**



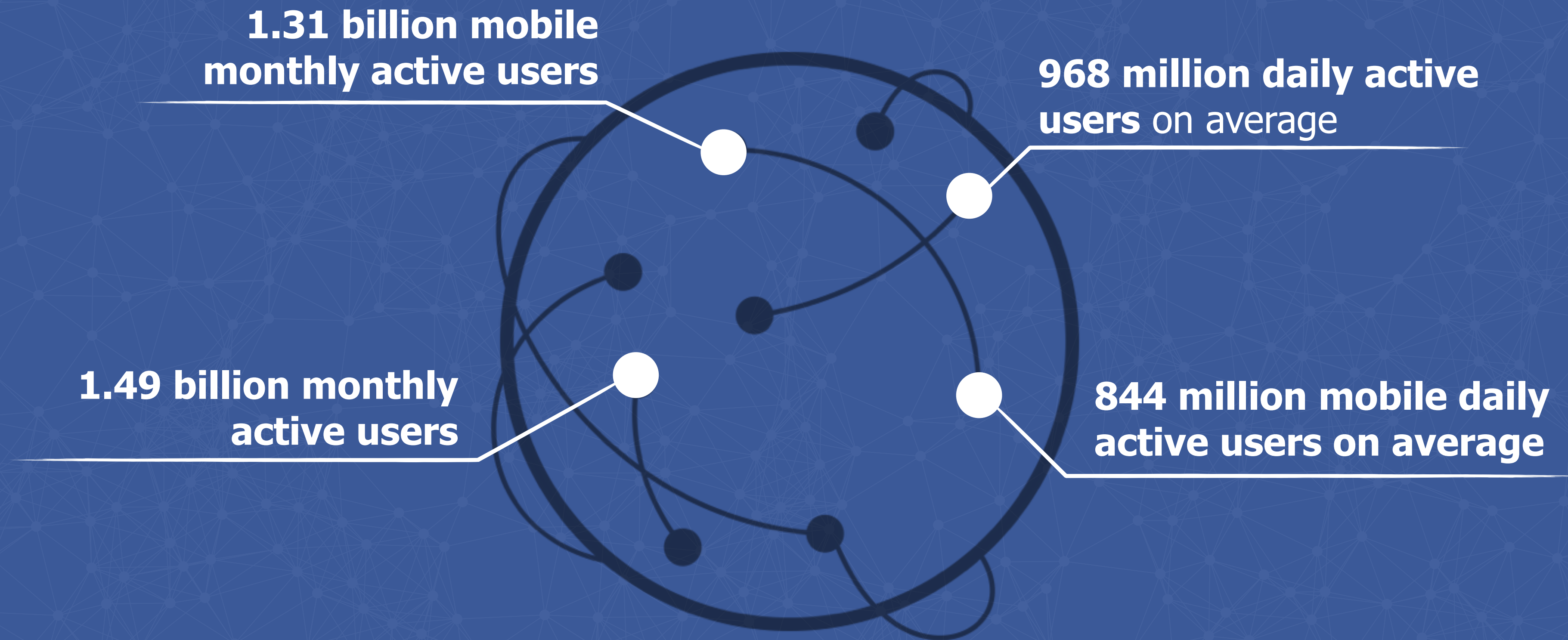


# Facebook scale



# Facebook scale

as of June 2015





# Facebook scale

as of June 2015



**Approximately 83.1% of our daily active users are outside the US and Canada**



A hand is shown in the bottom left corner, pointing towards a topographic map. The map features contour lines and a network of lines that resemble a data or communication network. The background is a light blue color with a semi-transparent map overlay.

# What does that mean for the Facebook Network?



# Lots of traffic and global footprint



# Network traffic



Machine to machine

Machine to user



A LEGO minifigure of a woman with brown hair in a bun, wearing a white lab coat with blue markings, stands next to a grey and white LEGO robot. The robot is built on a white base and has a grey body with a circular sensor on its head. The background is dark with a faint, repeating pattern of the letters 'COU'.

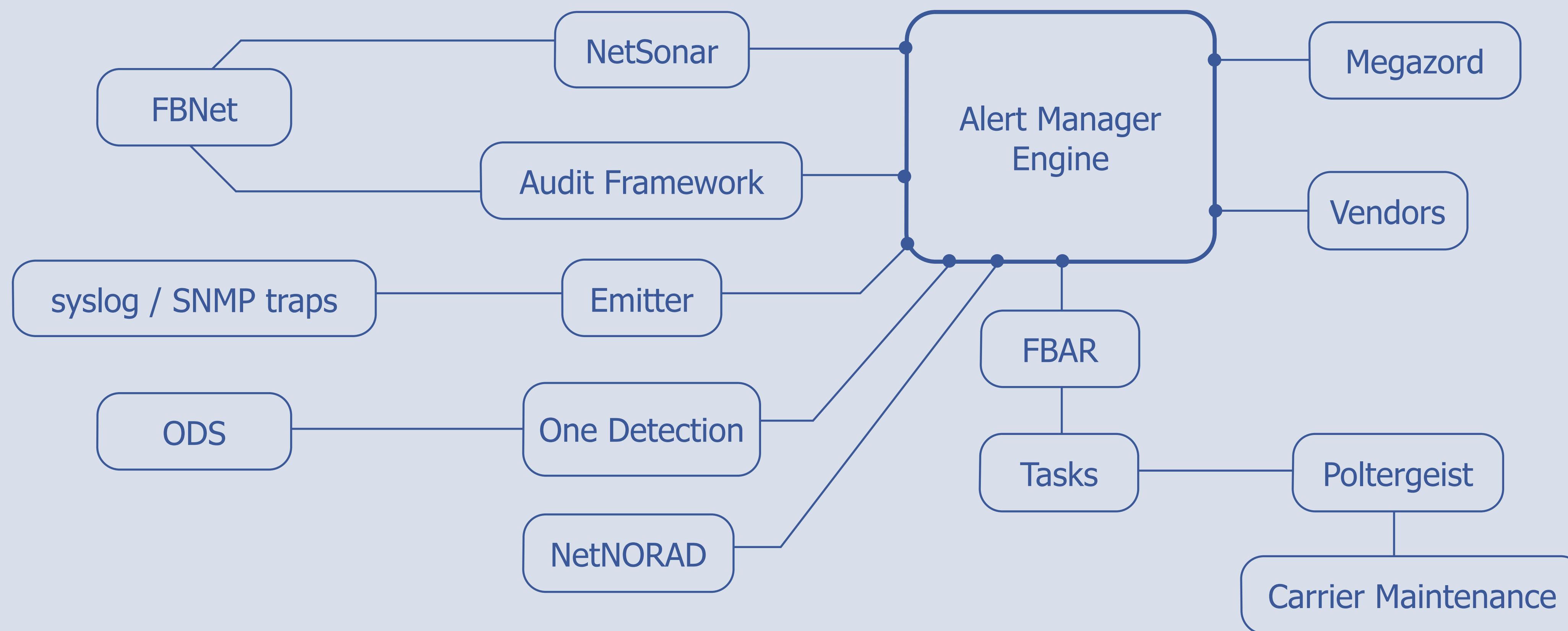
**Engineers build robots,  
robots manage the network**



# Facebook Defined Networking



# Facebook Defined Networking





# FBNet

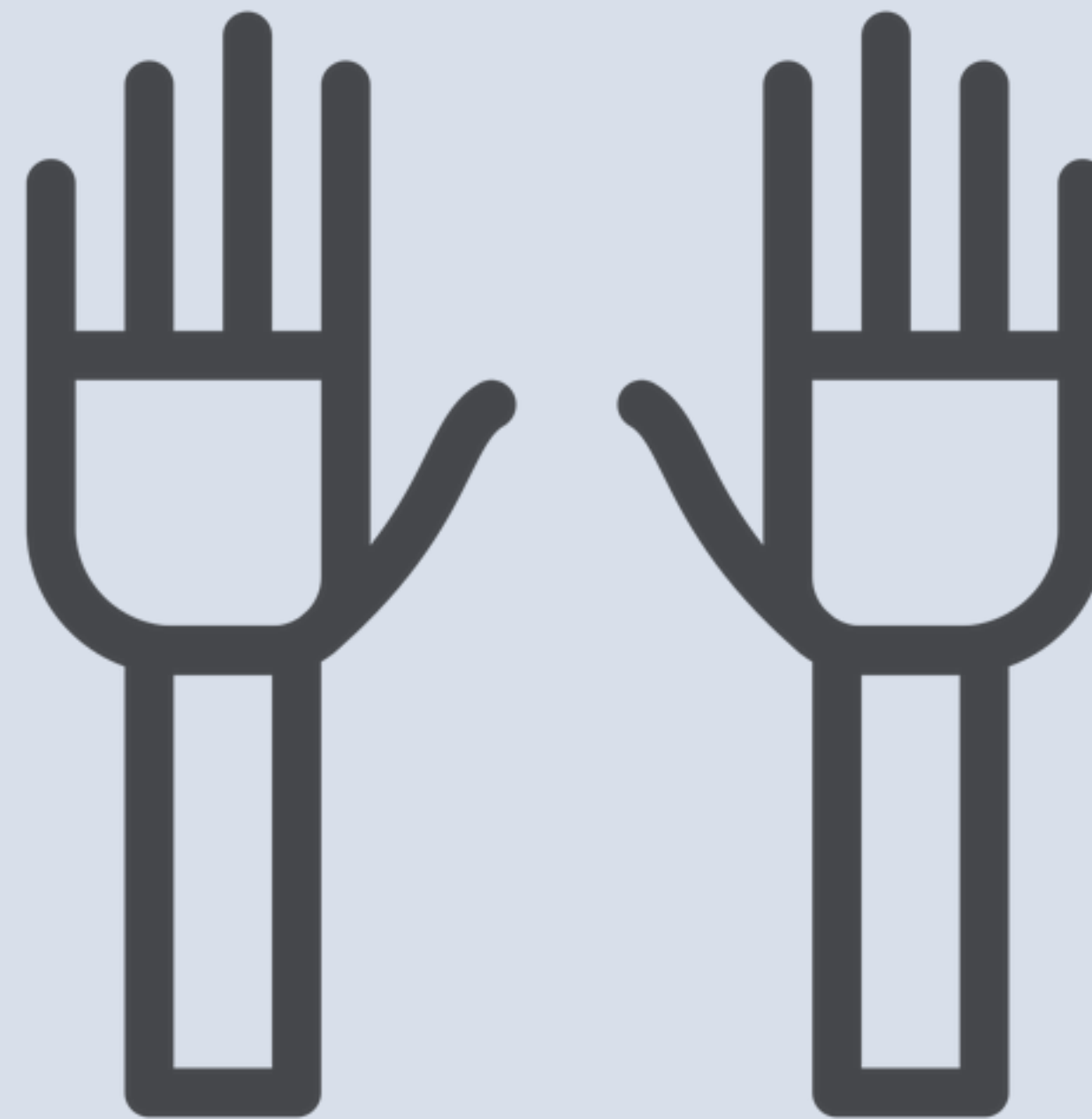
The brains to help guide our robots run the network





# Drain Services

The movers of traffic on the network devices





# NetNORAD

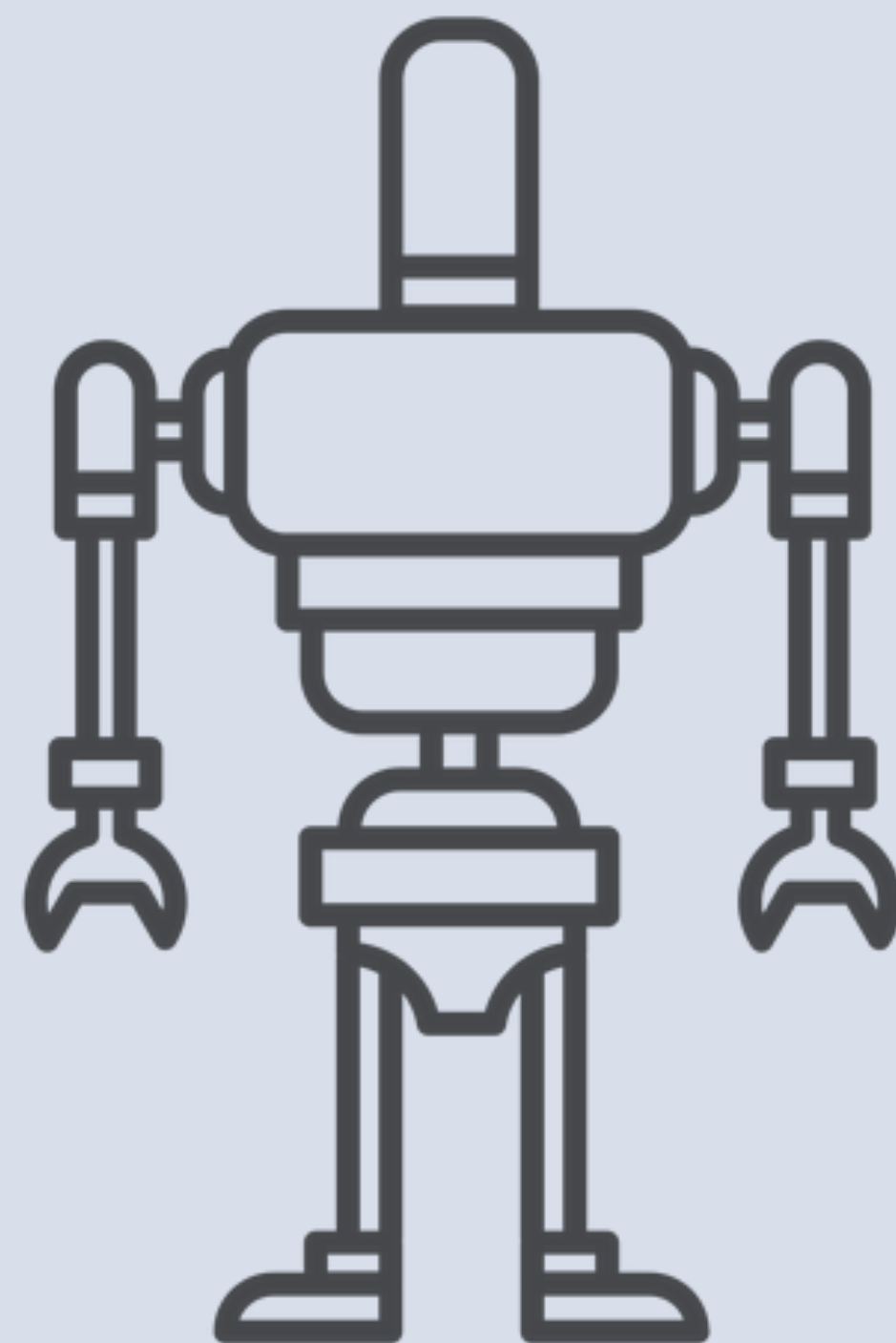
Our Packet Loss detection system





# Megazord

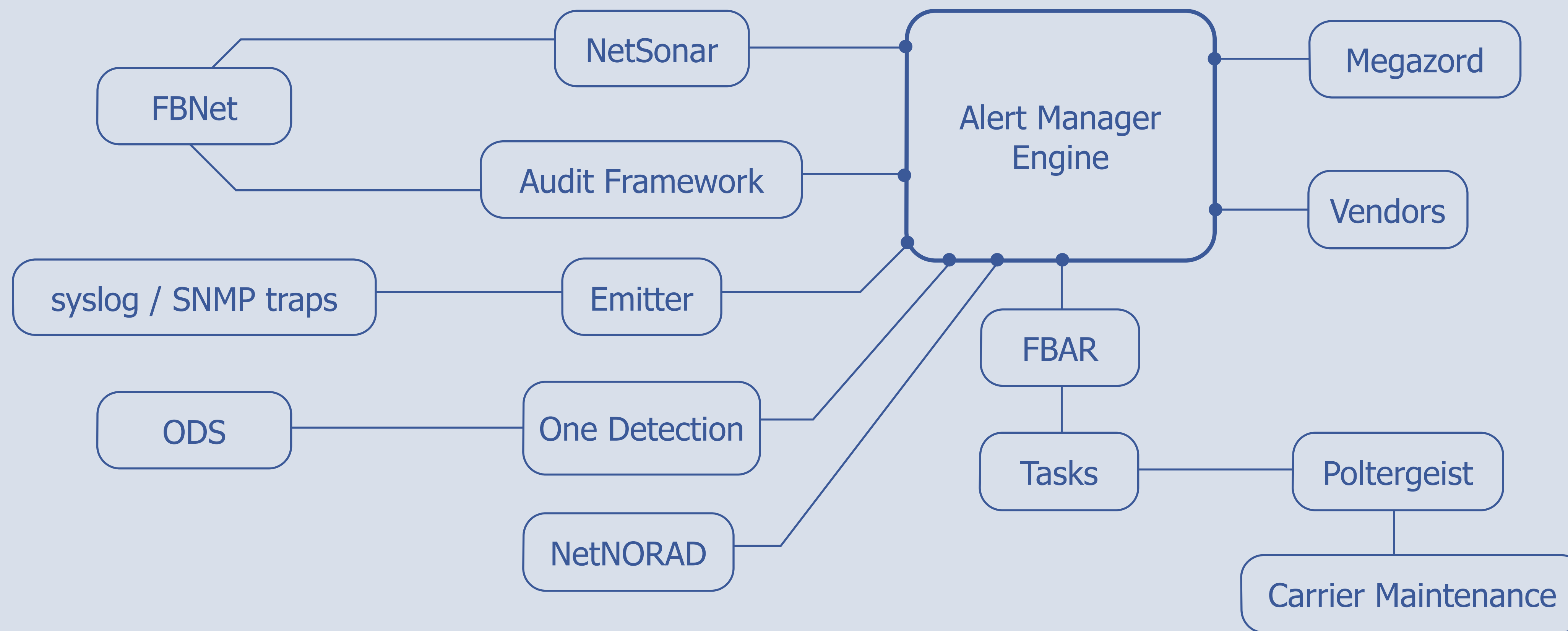
Our alarm correlation engine





# Facebook Defined Networking

all components in action





A low-angle shot of several colorful umbrellas (green, blue, purple) against a clear blue sky. The umbrellas are suspended from a metal structure, likely a Ferris wheel or a similar ride. The text "Tales from the real world" is overlaid in white, bold, sans-serif font in the center of the image.

# Tales from the real world



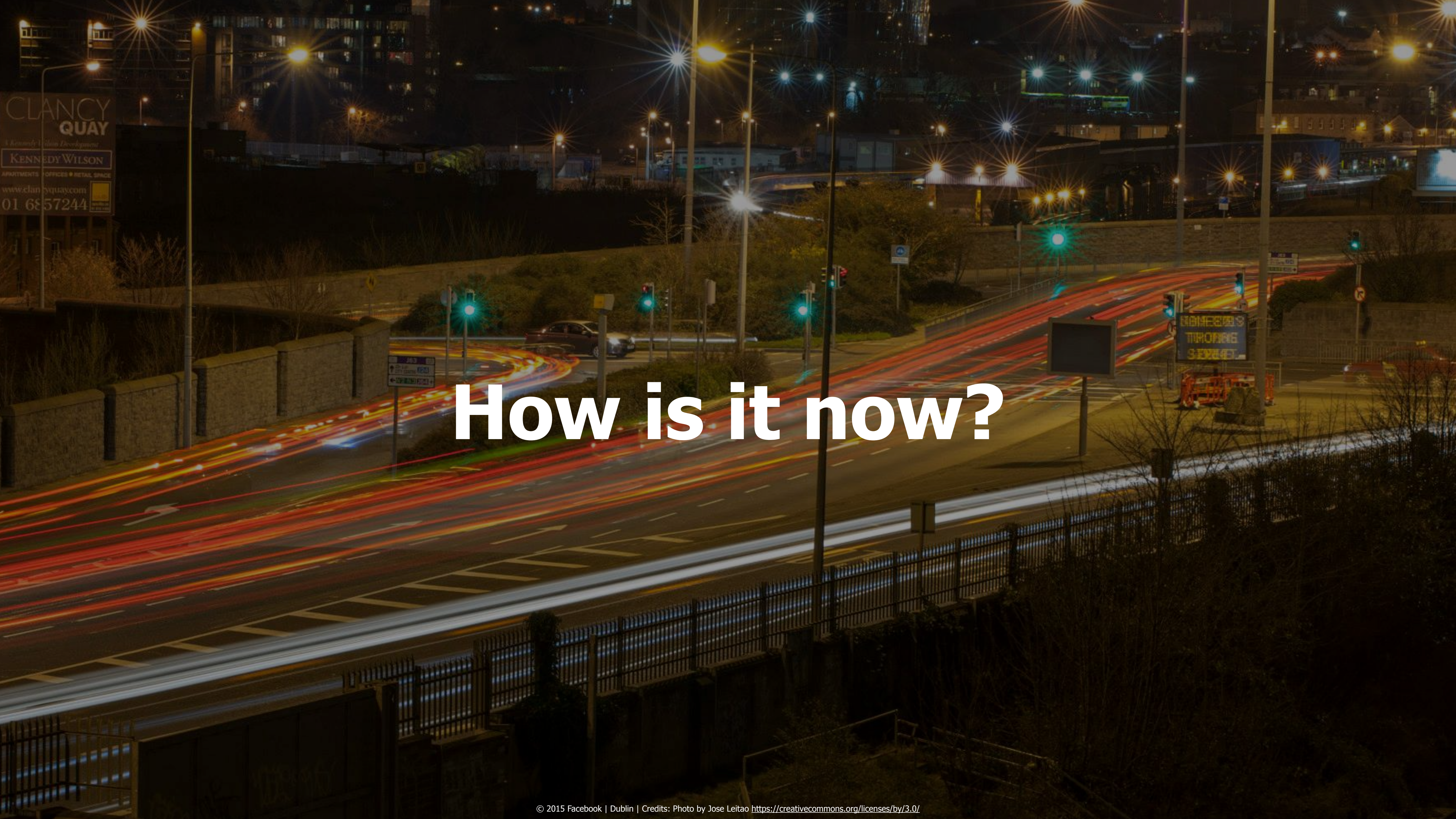
# Circuits @ scale

Manual approach



Hybrid approach





# How is it now?





**Fully automated**



# How is it now?

**Notification  
from vendor**





# How is it now?



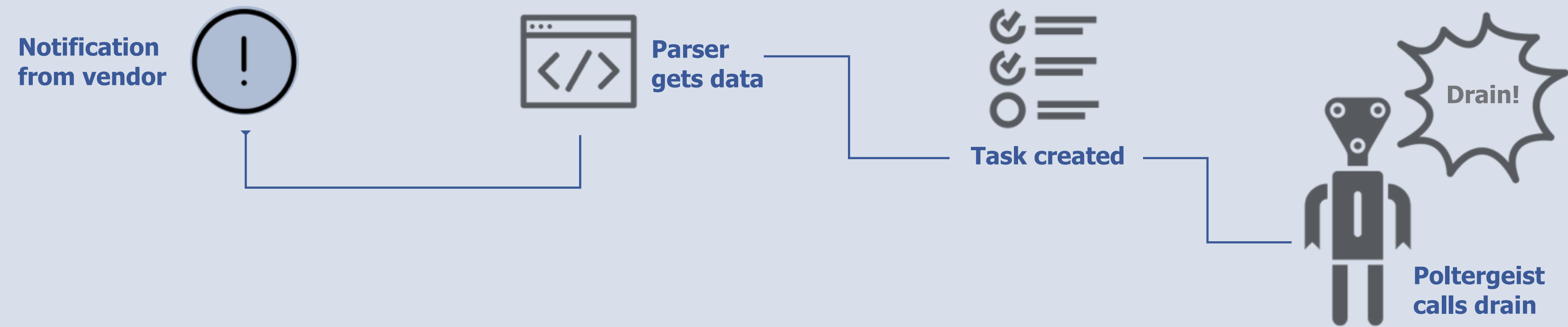


# How is it now?



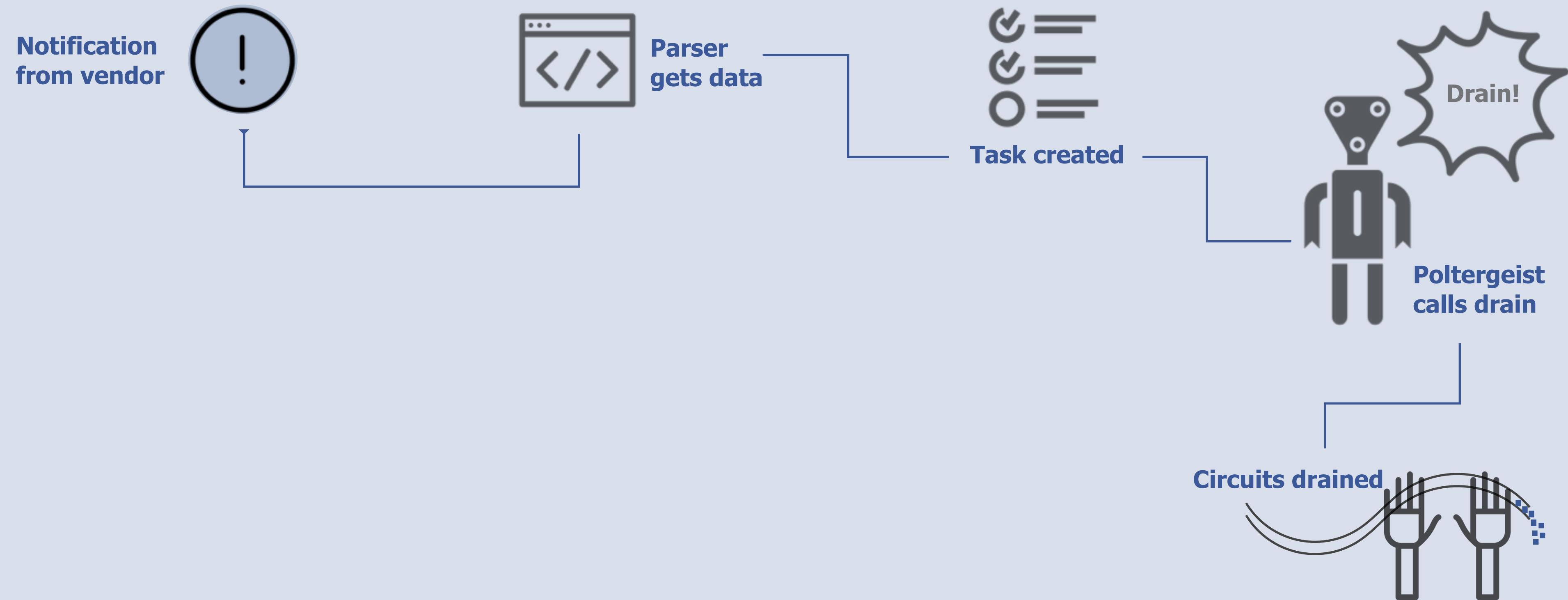


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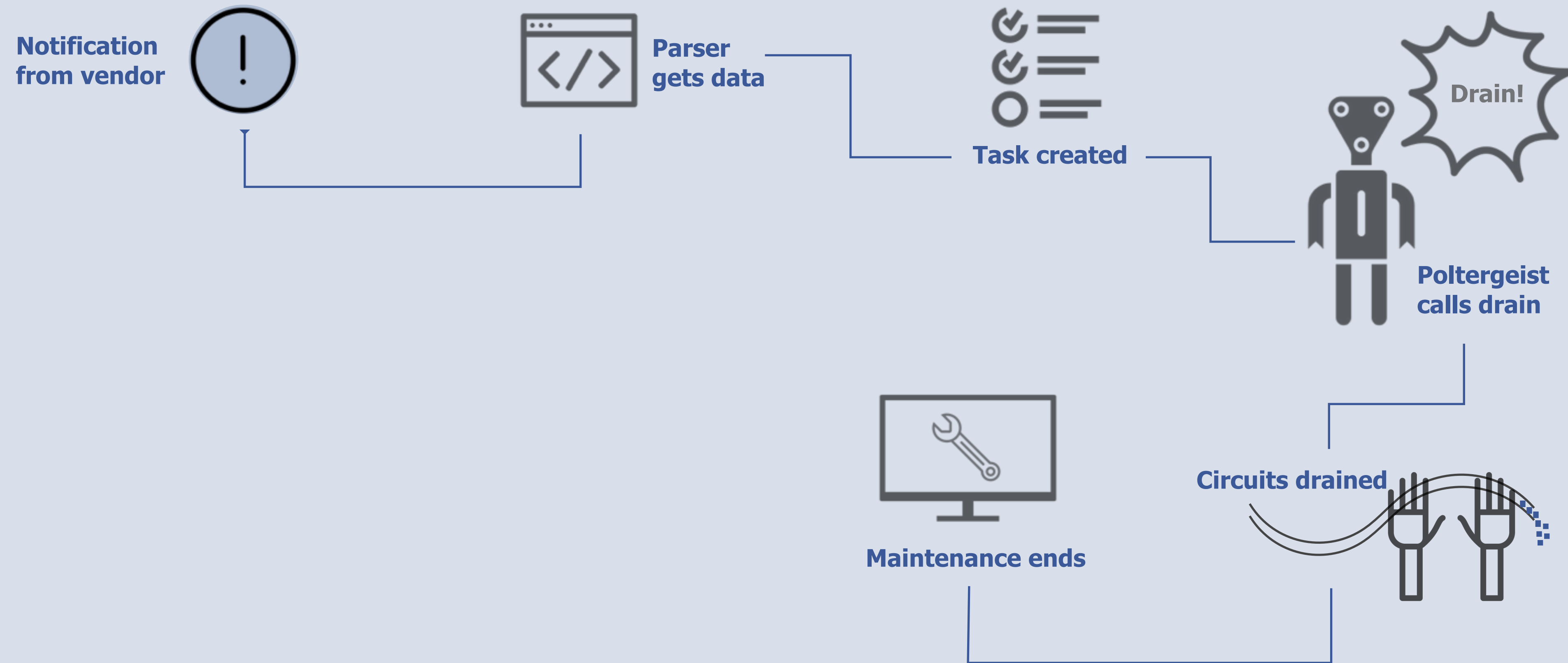


# How is it now?



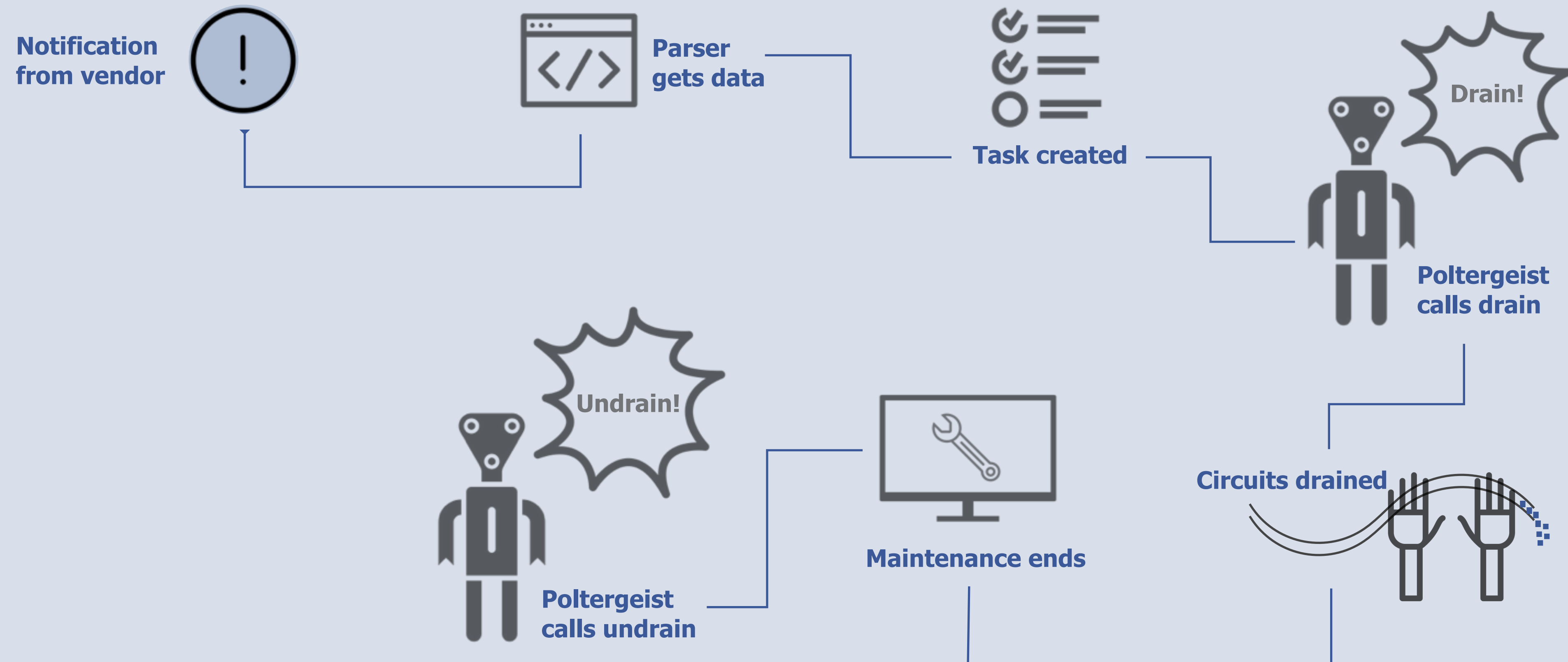


# How is it now?



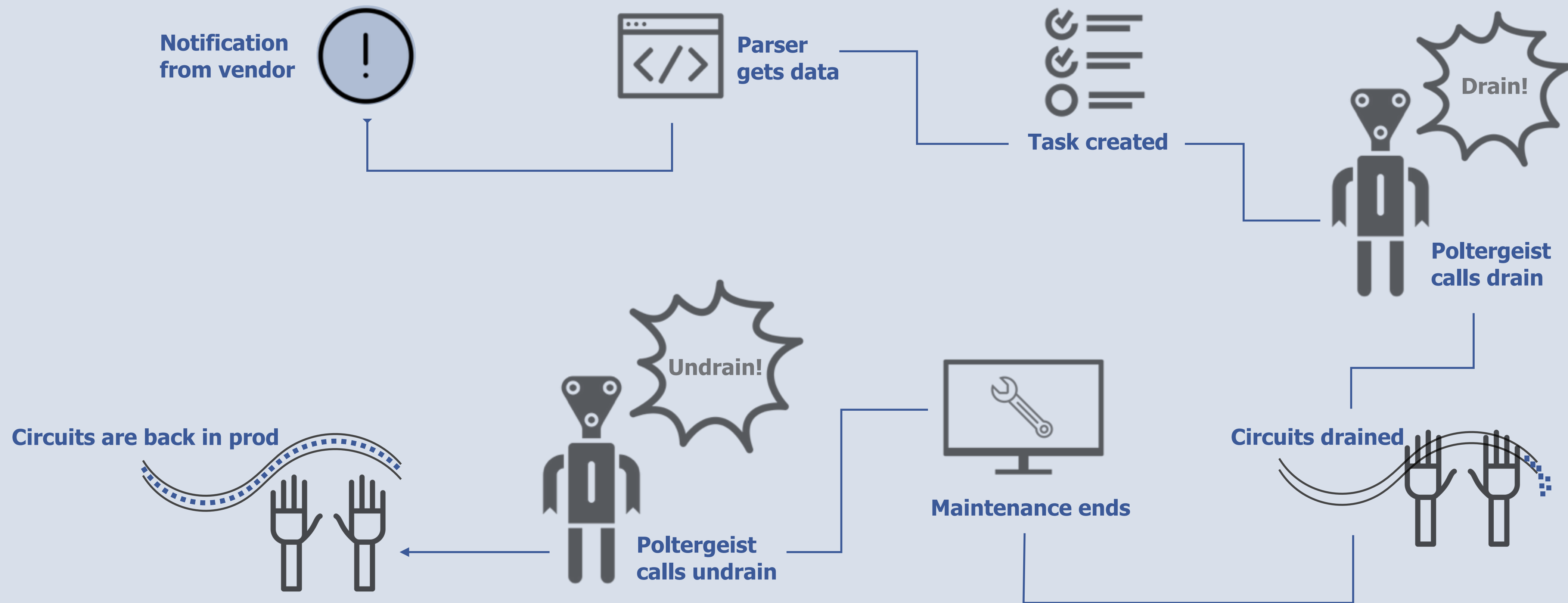


# How is it now?





# How is it now?





A school of hammerhead sharks swimming in clear blue water. The sharks are silhouetted against the light blue background, showing their characteristic wide, flat heads and pointed snouts. They are swimming in various directions, creating a sense of movement and depth.

# What about fiber-eating sharks?



# Seriously...





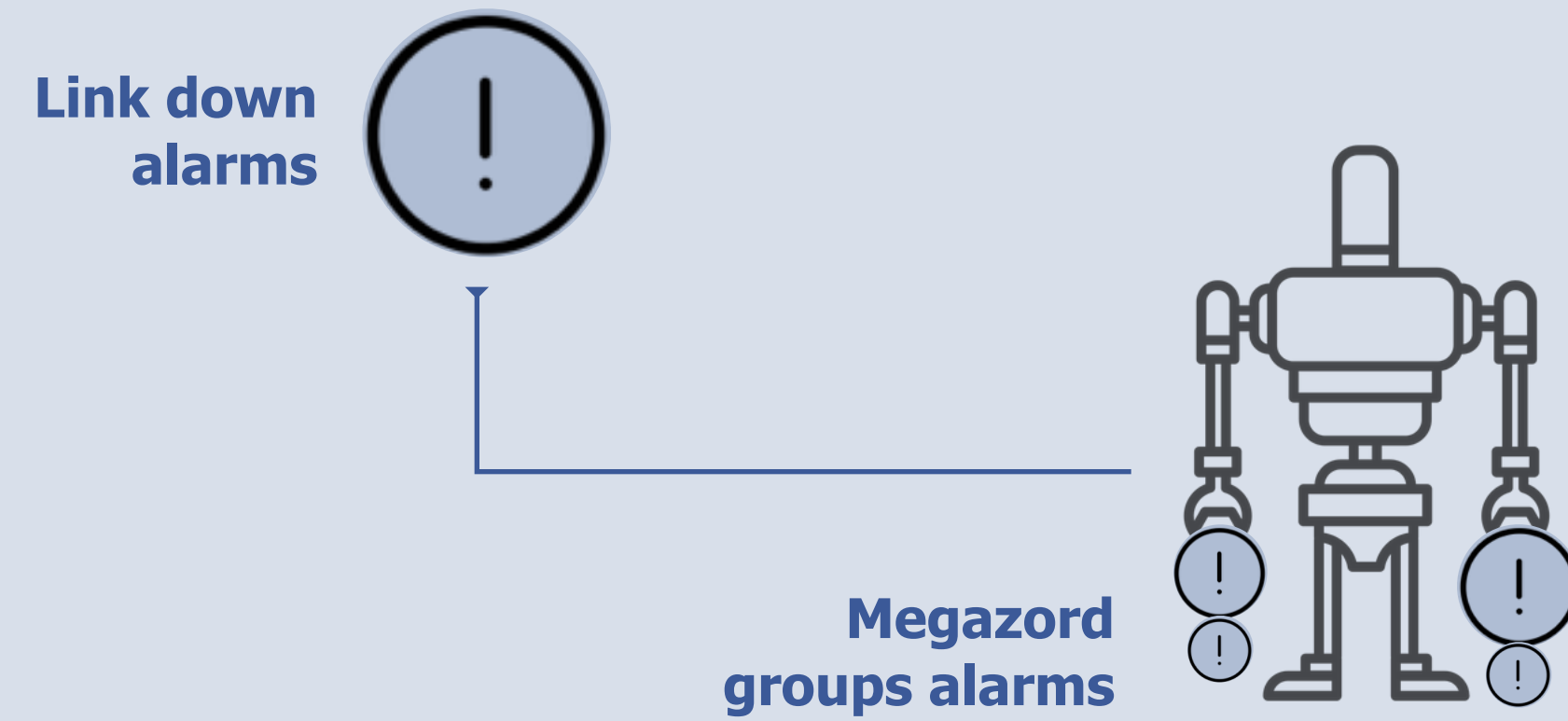
# How is it now?

**Link down  
alarms**



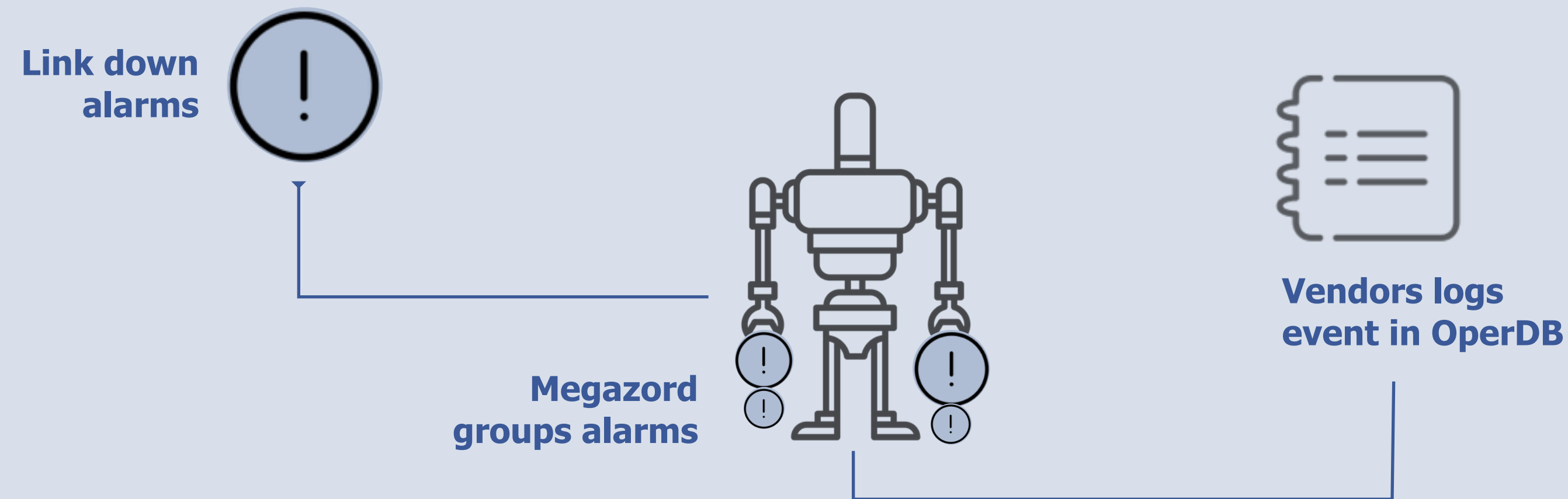


# How is it now?



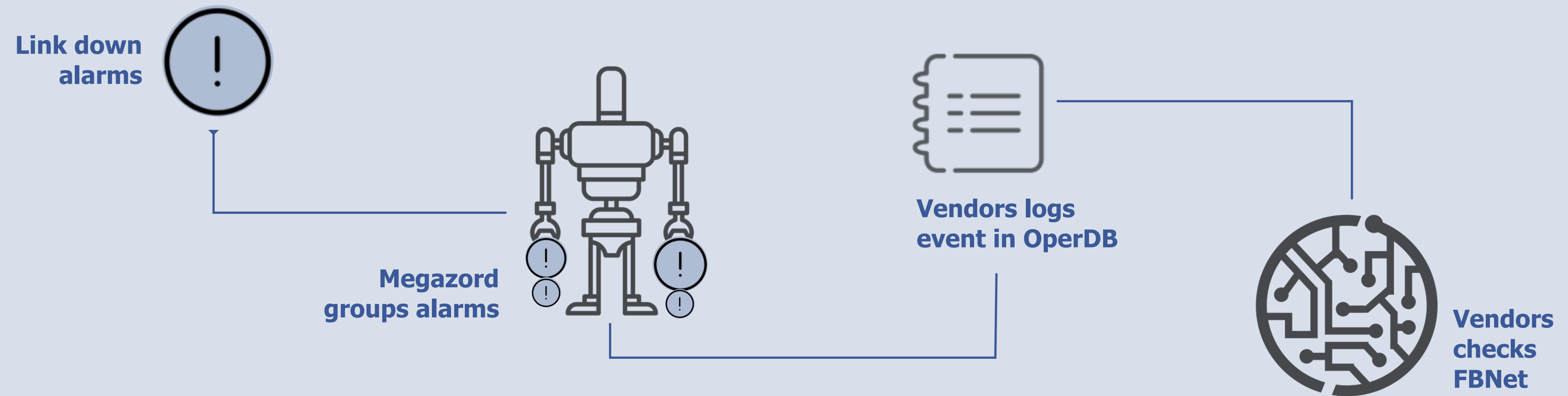


# How is it now?



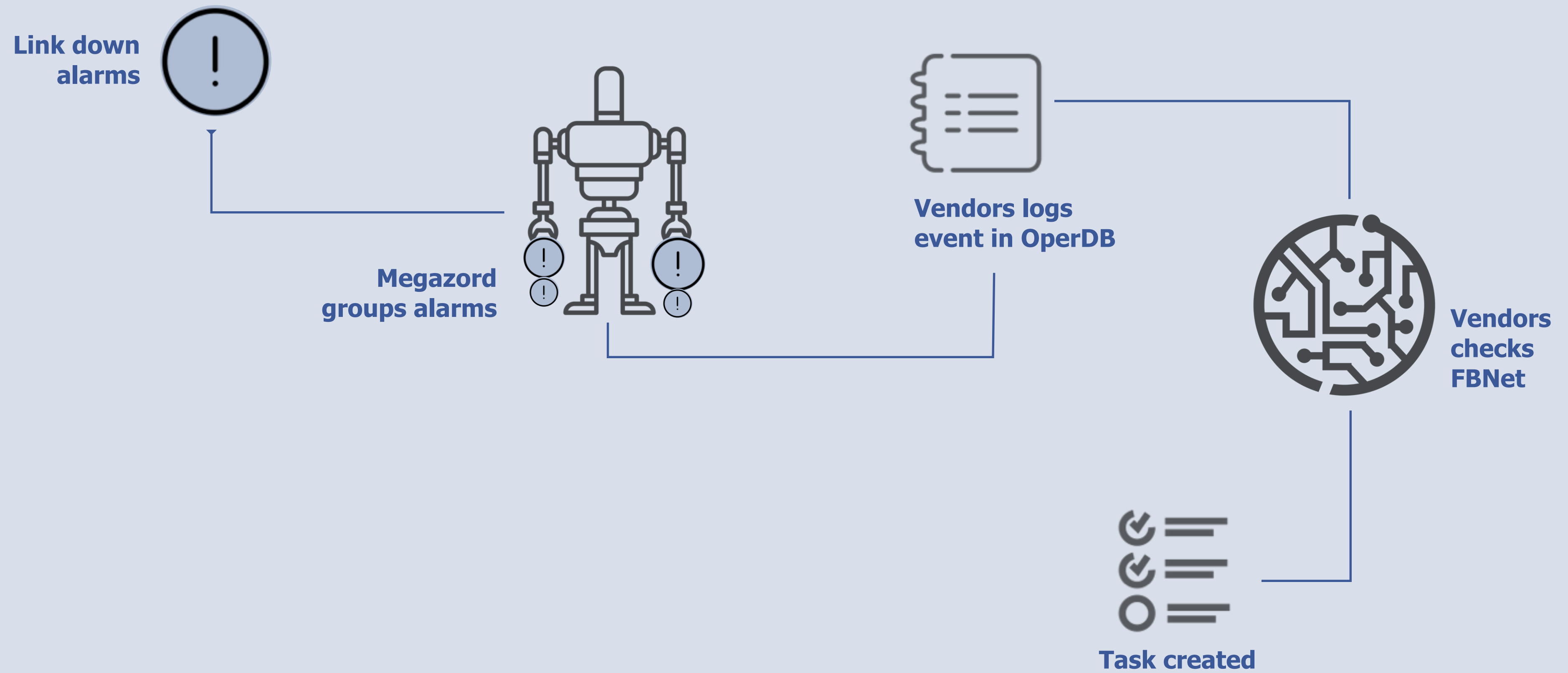


# How is it now?



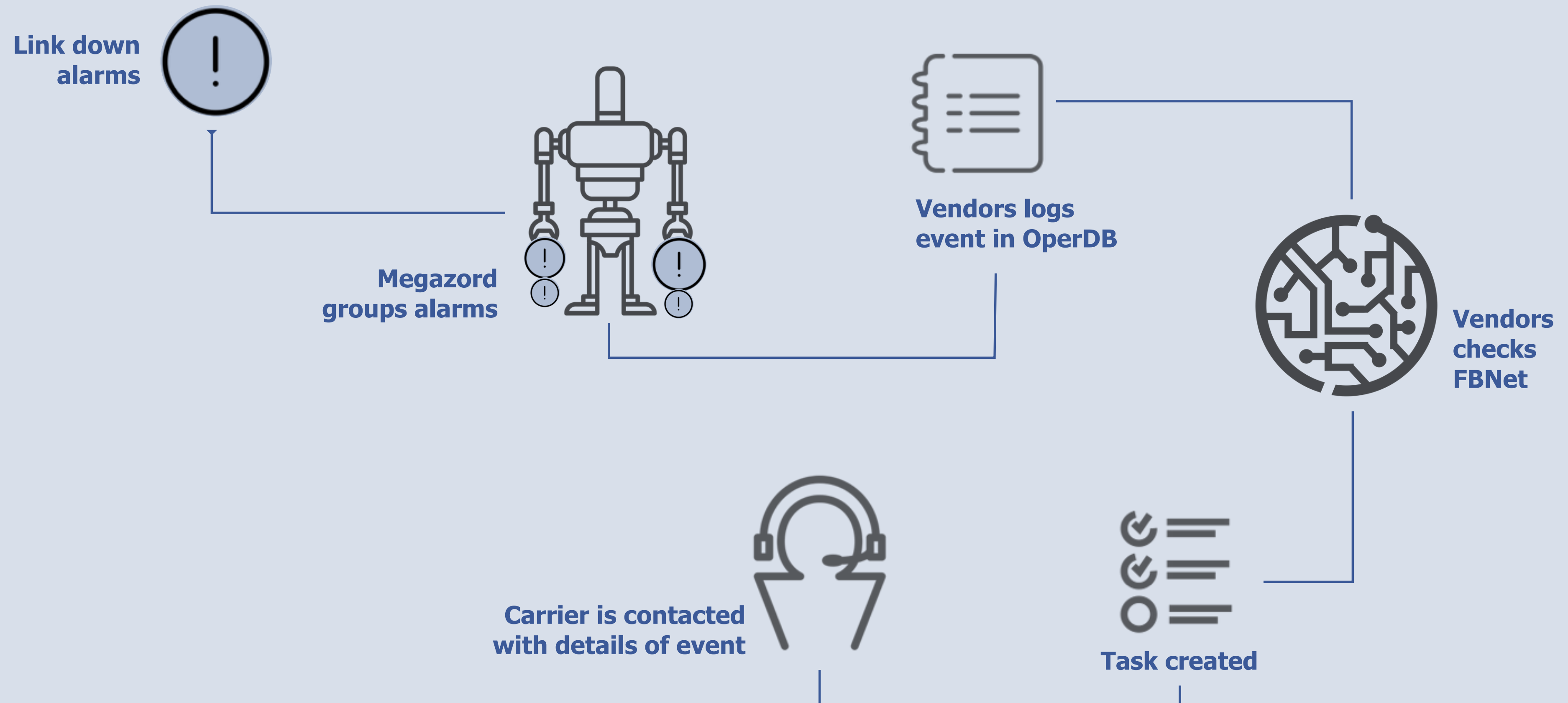


# How is it now?



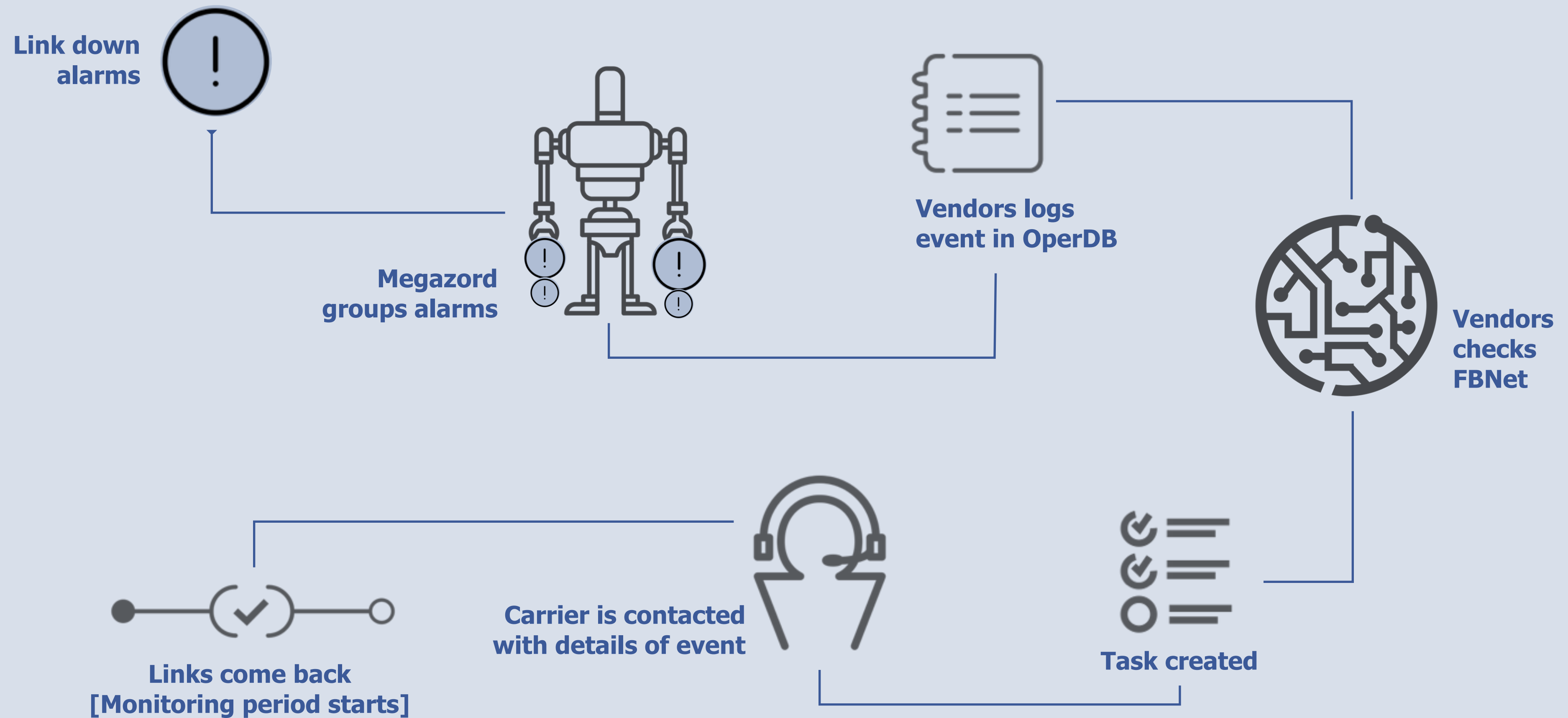


# How is it now?



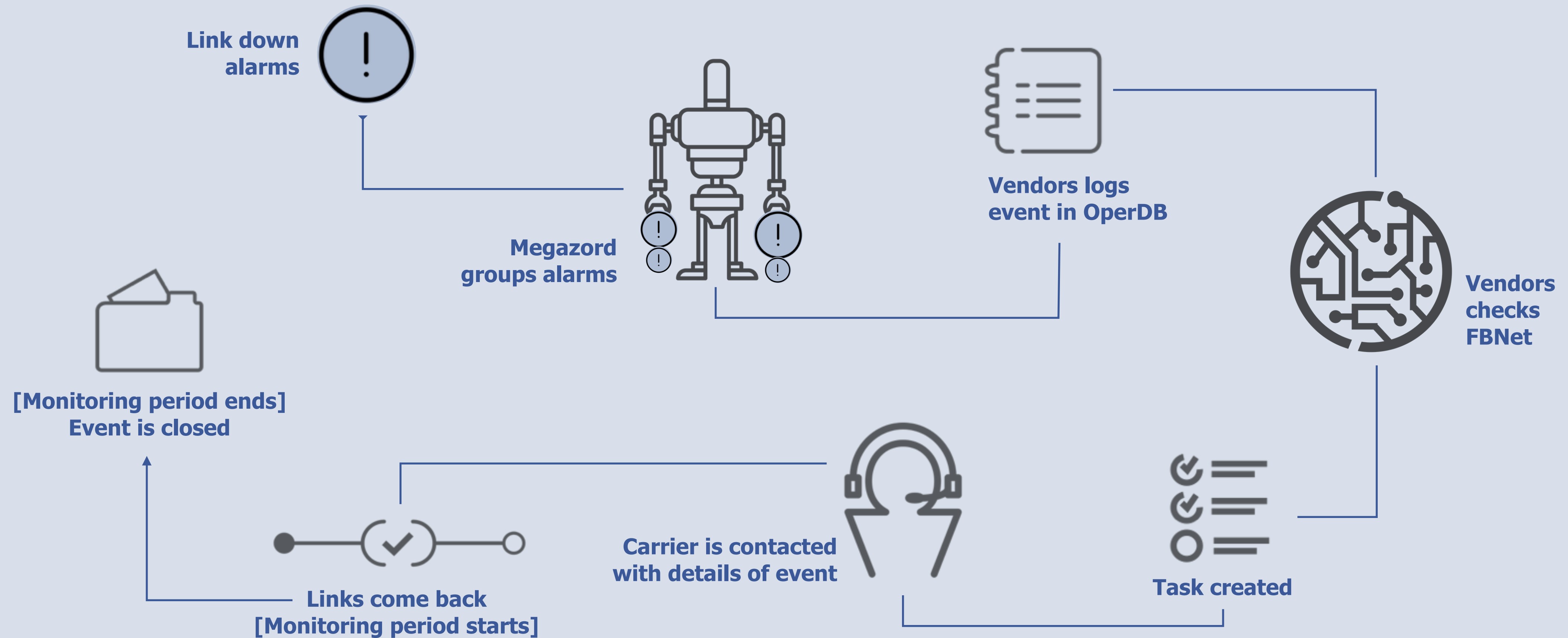


# How is it now?





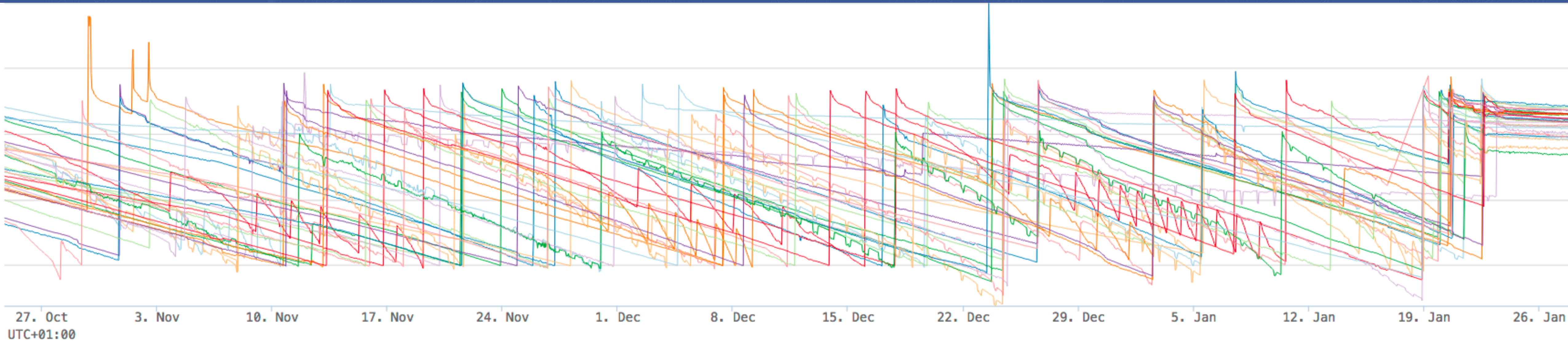
# How is it now?





# The memory leak debacle

Free memory over time





The background of the image is Raphael's famous fresco, 'The School of Athens'. It depicts a group of ancient Greek philosophers gathered in a grand, classical building. The scene is filled with various figures, including Plato and Aristotle in the center, surrounded by other prominent thinkers like Socrates, Pythagoras, and Euclid. The architecture features high arches, columns, and intricate ceiling patterns. The overall tone is intellectual and historical.

**How would this be solved with humans?**





**Lots of them + coffee**



# How is it now?



**ODS detector  
for free memory  
goes bellow threshold**



# How is it now?



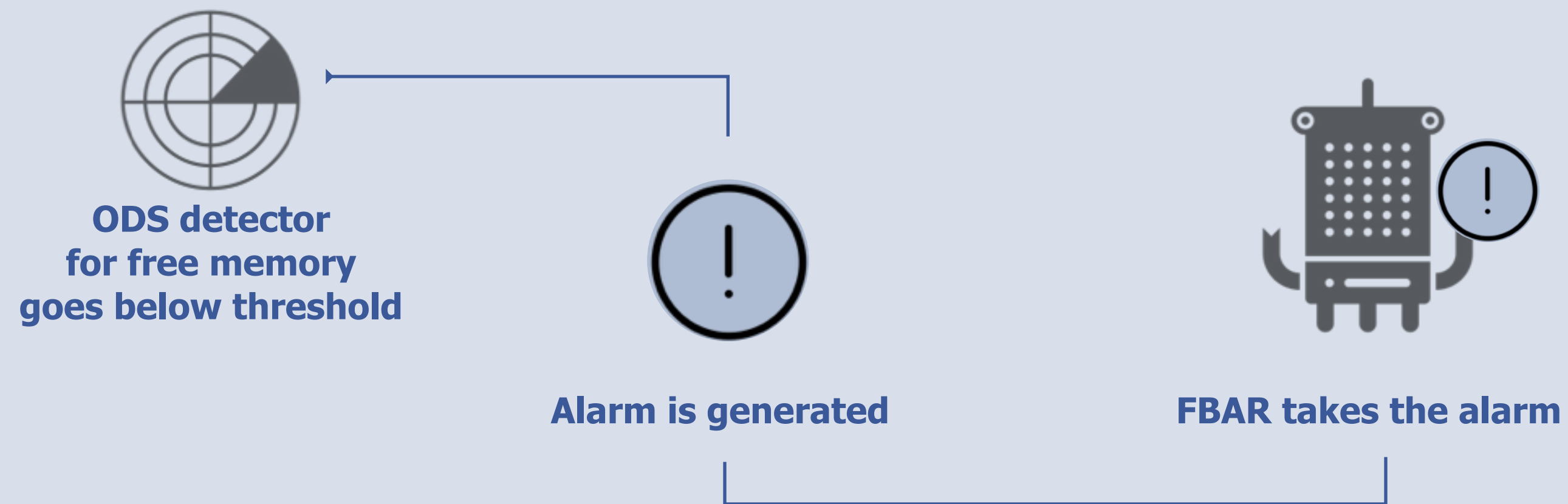
**ODS detector  
for free memory  
goes bellow threshold**



**Alarm is generated**

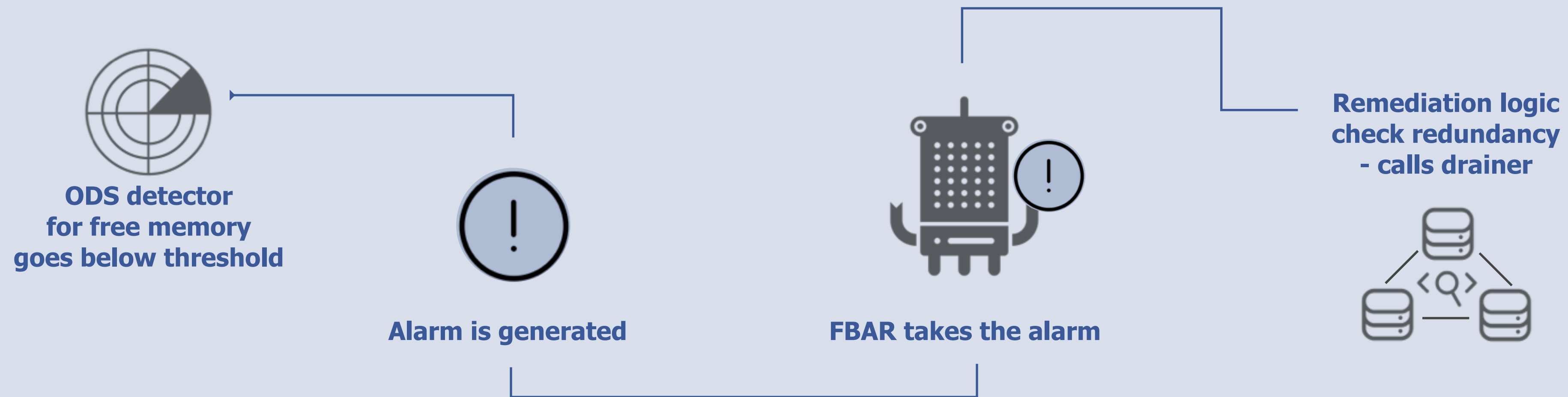


# How is it now?



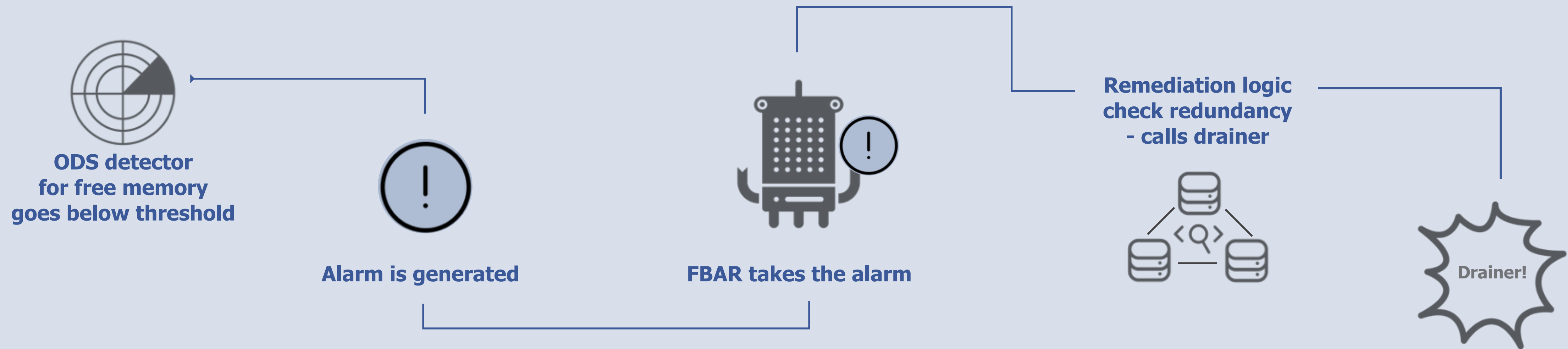


# How is it now?



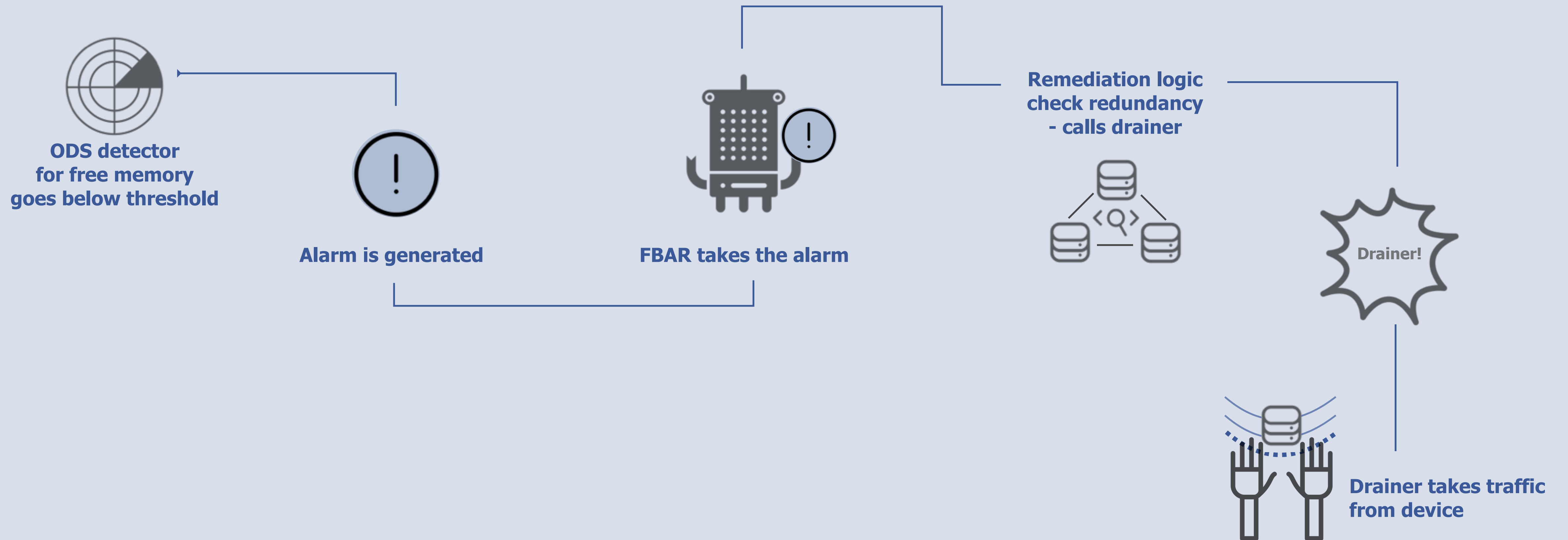


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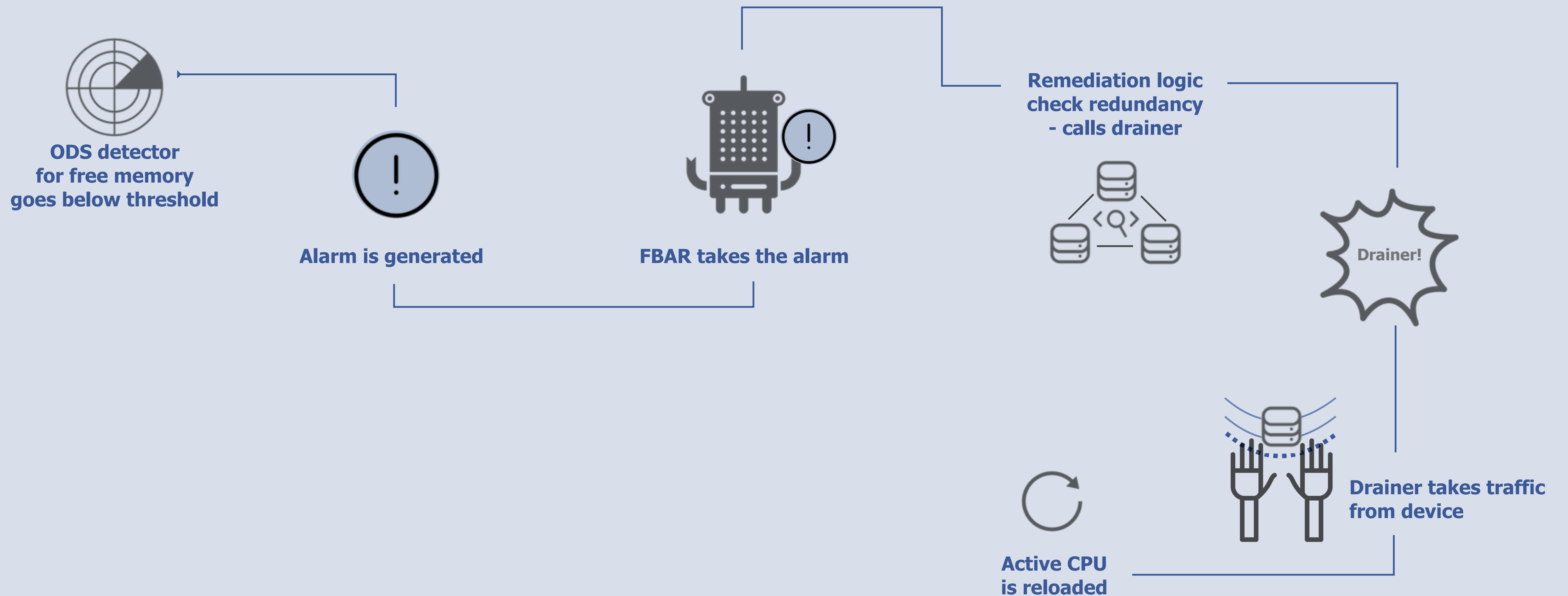


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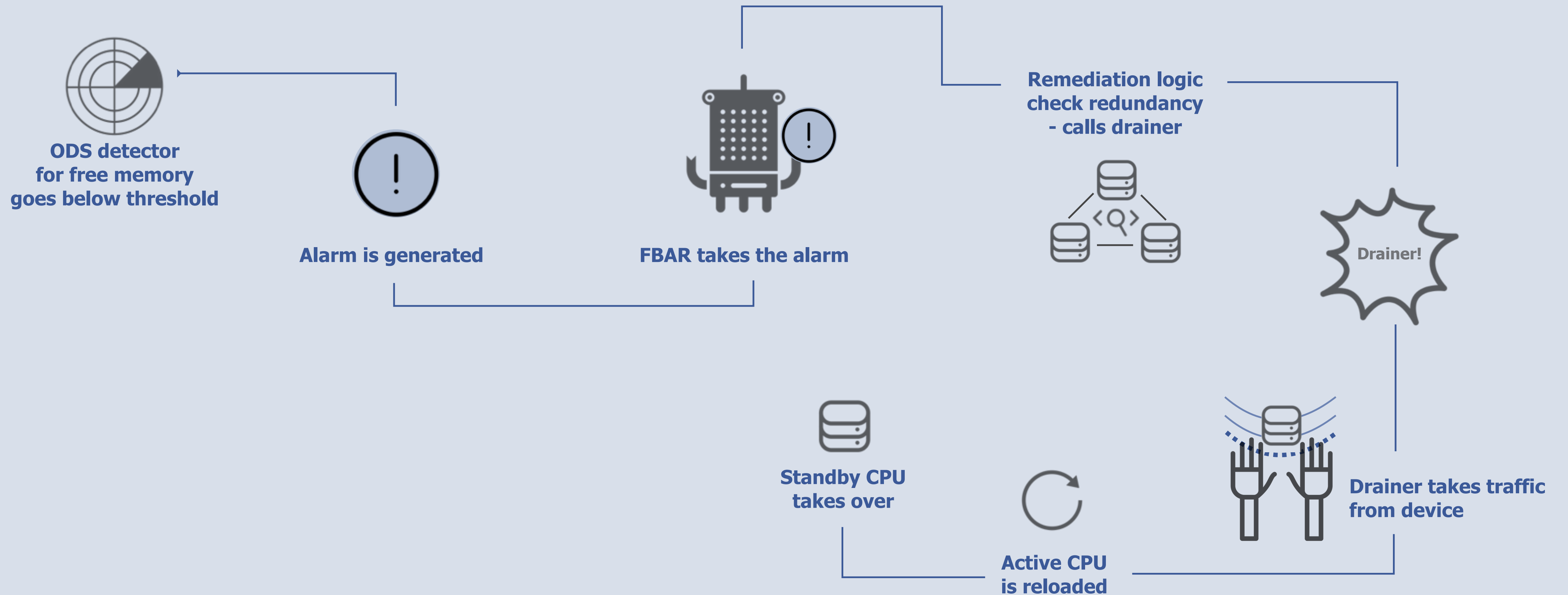


# How is it now?



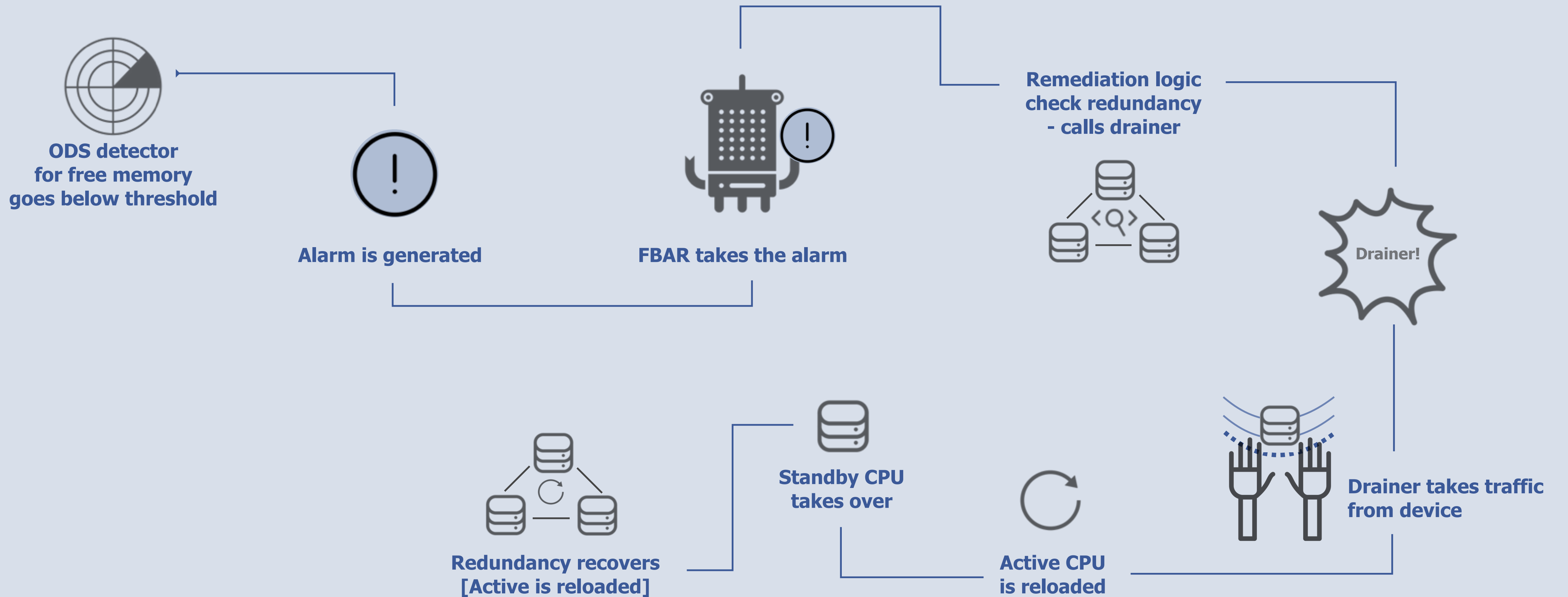


# How is it now?



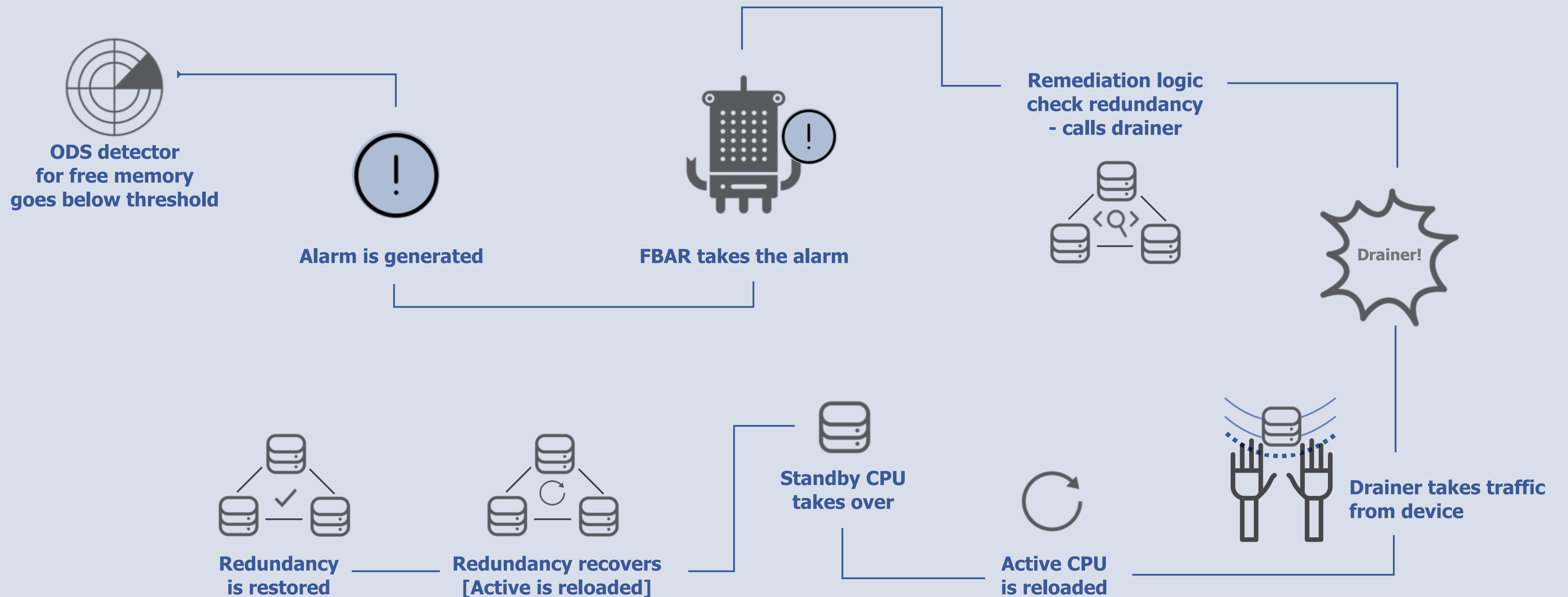


# How is it now?



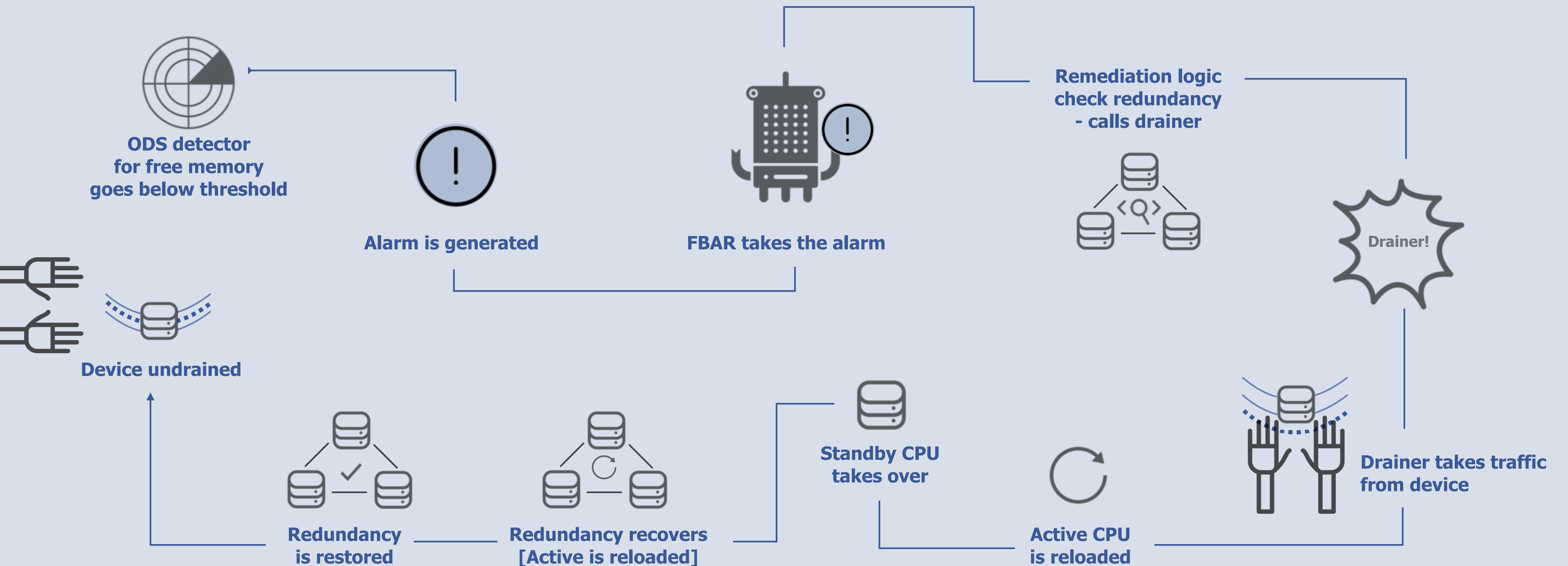


# How is it now?





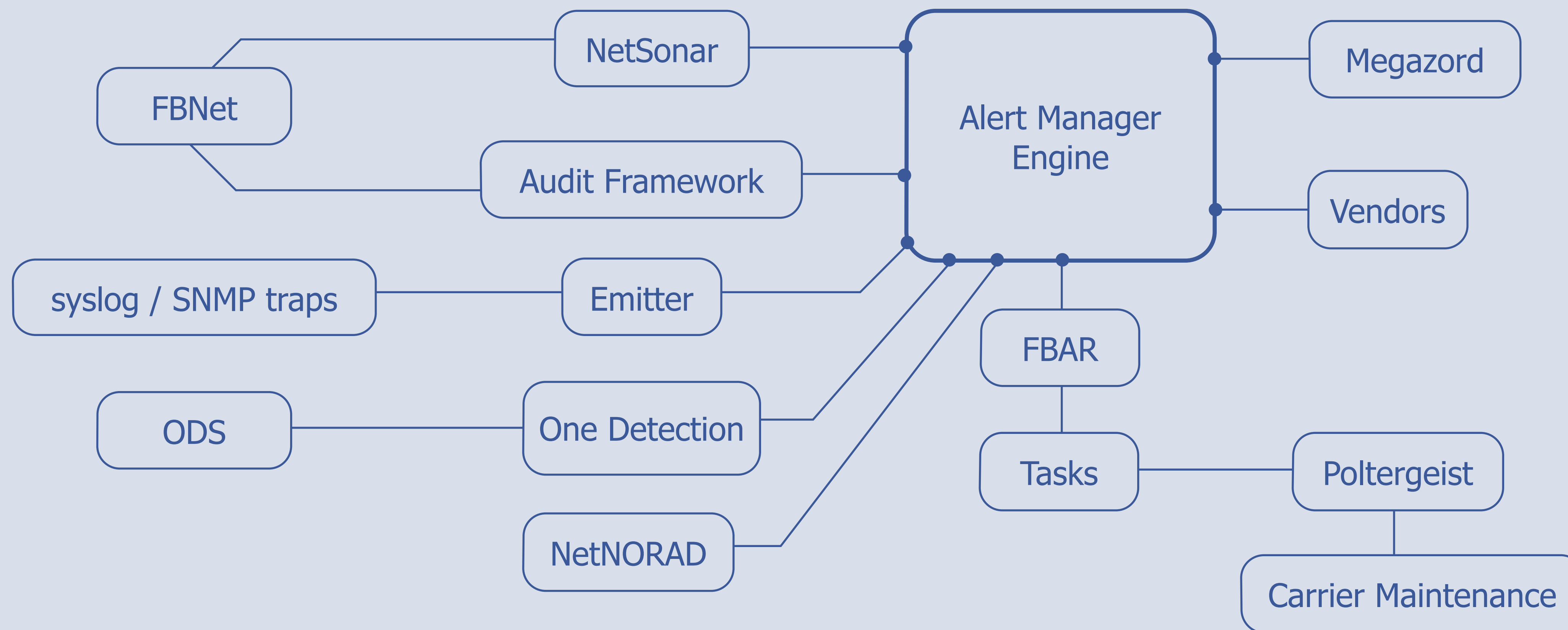
# How is it now?





# Facebook Defined Networking

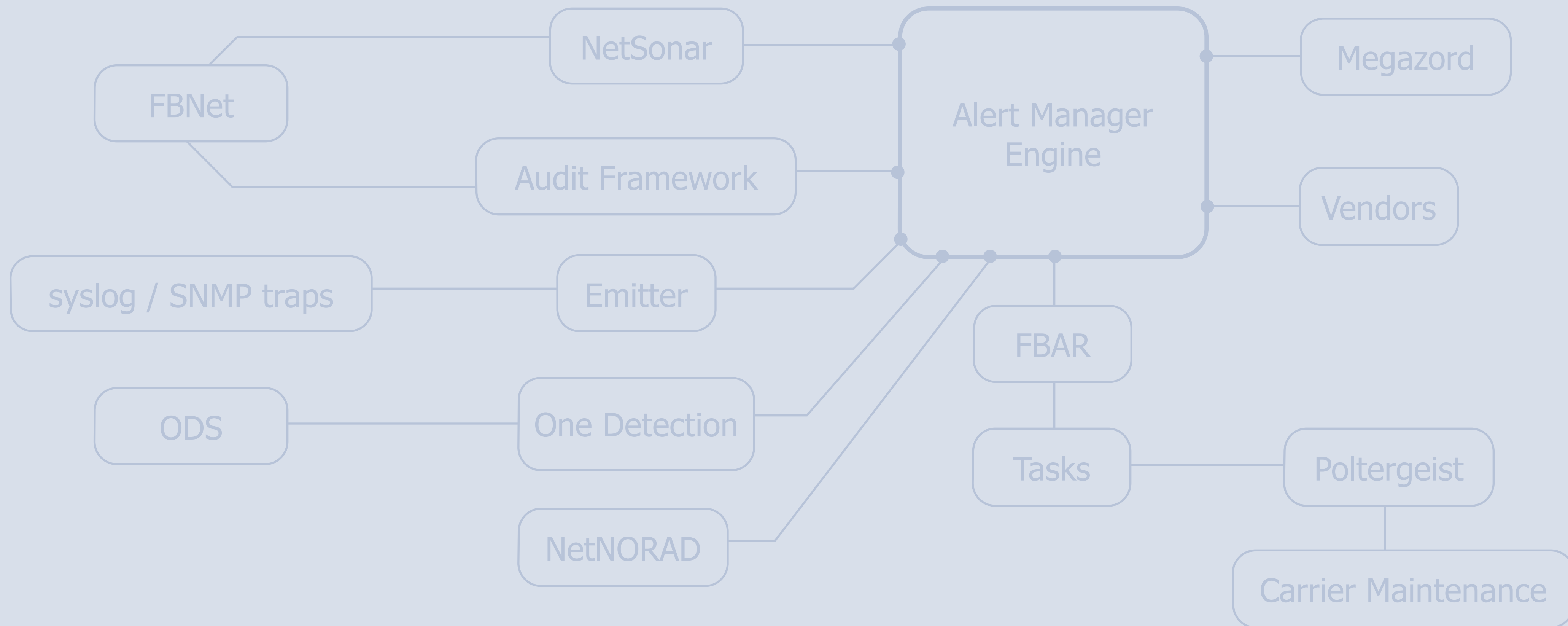
all components in action





# So, in 30 days...

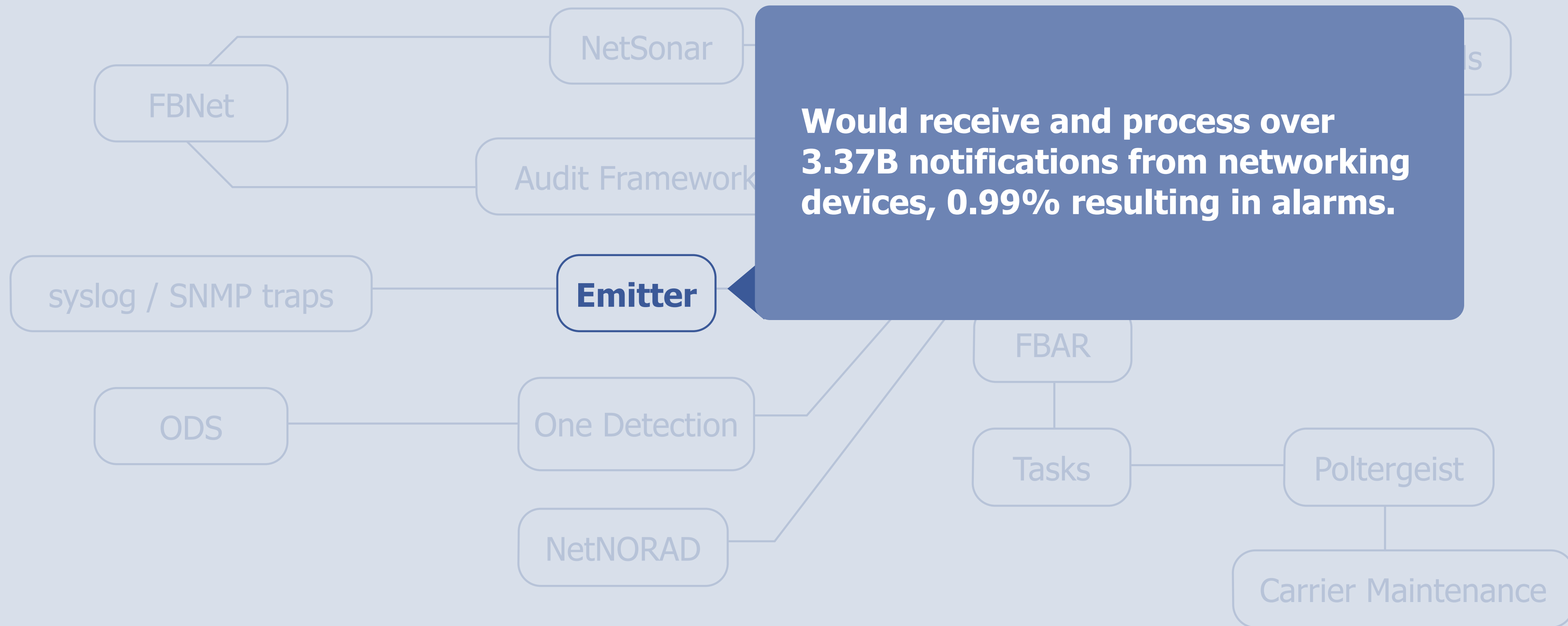
all components in action





# So, in 30 days...

all components in action





# So, in 30 days...

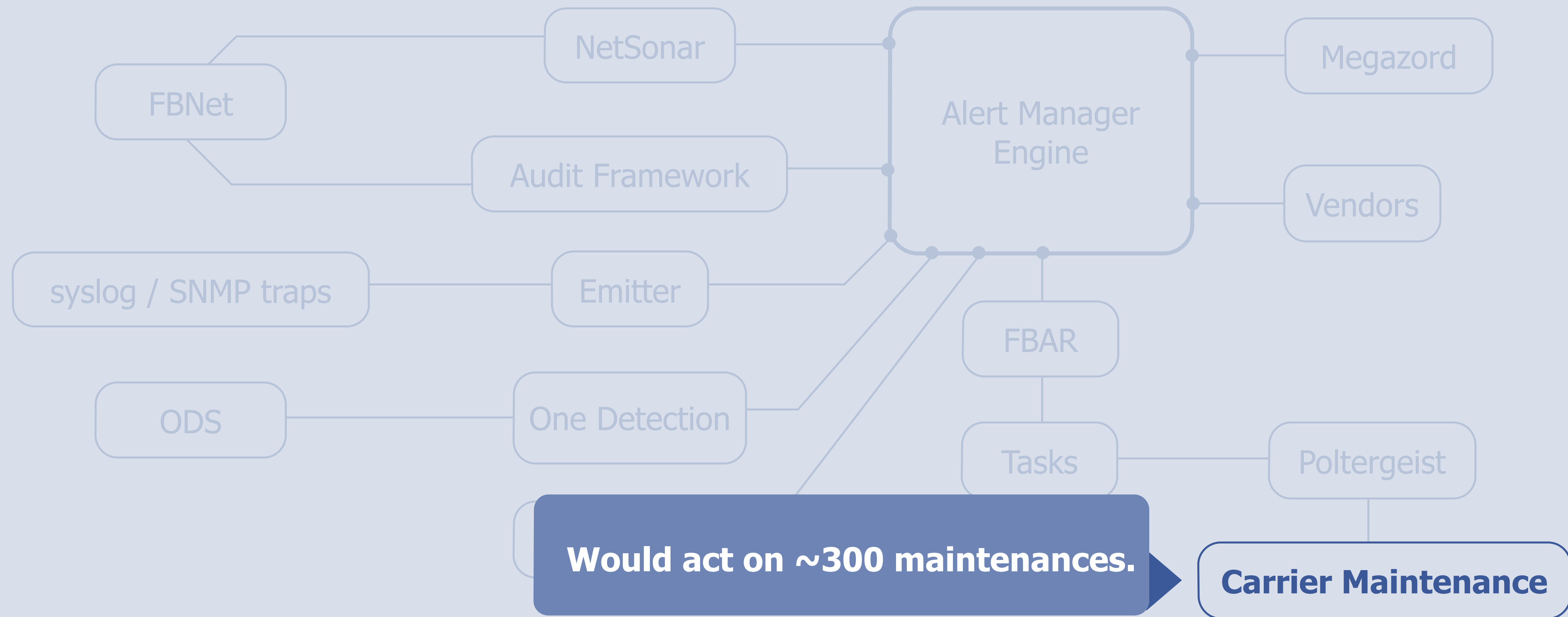
all components in action





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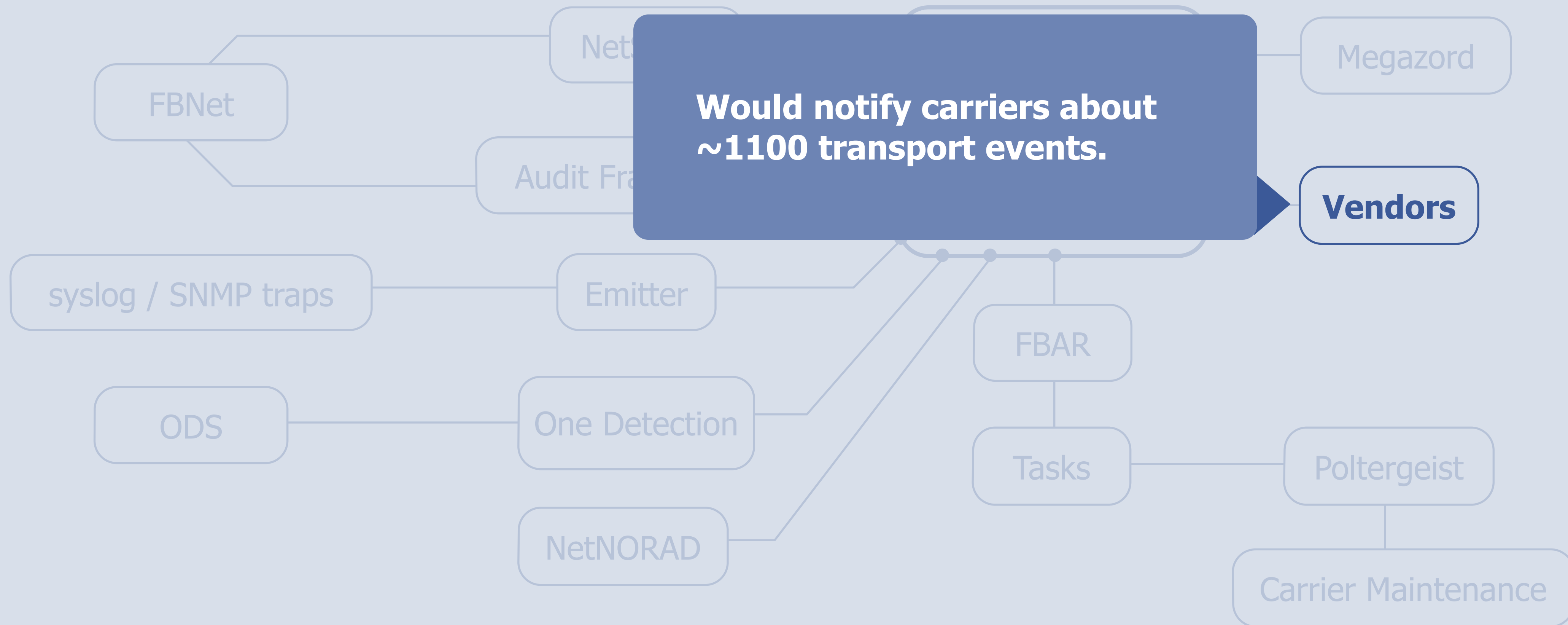
all components in action





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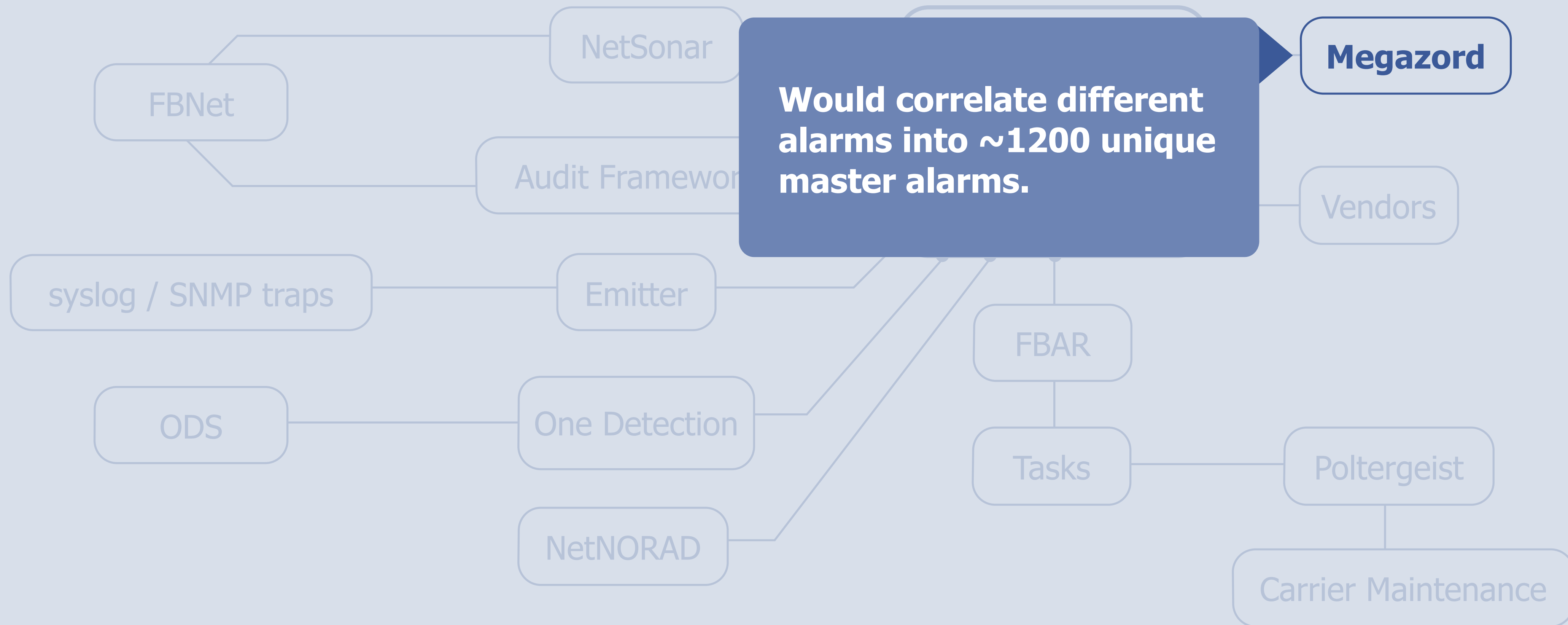
all components in action





# So, in 30 days...

all components in action





Three tin wind-up robots are shown standing side-by-side. The robot on the left is silver with red eyes and a yellow mouth. The middle robot is blue with yellow eyes and a yellow mouth. The robot on the right is green with red eyes and a yellow mouth. All three robots have a grey face, a silver body, and red feet. They are connected by a central grey rod. The text "Single on-call in charge of the whole network" is overlaid in white on the robots.

**Single on-call in charge of the whole network**

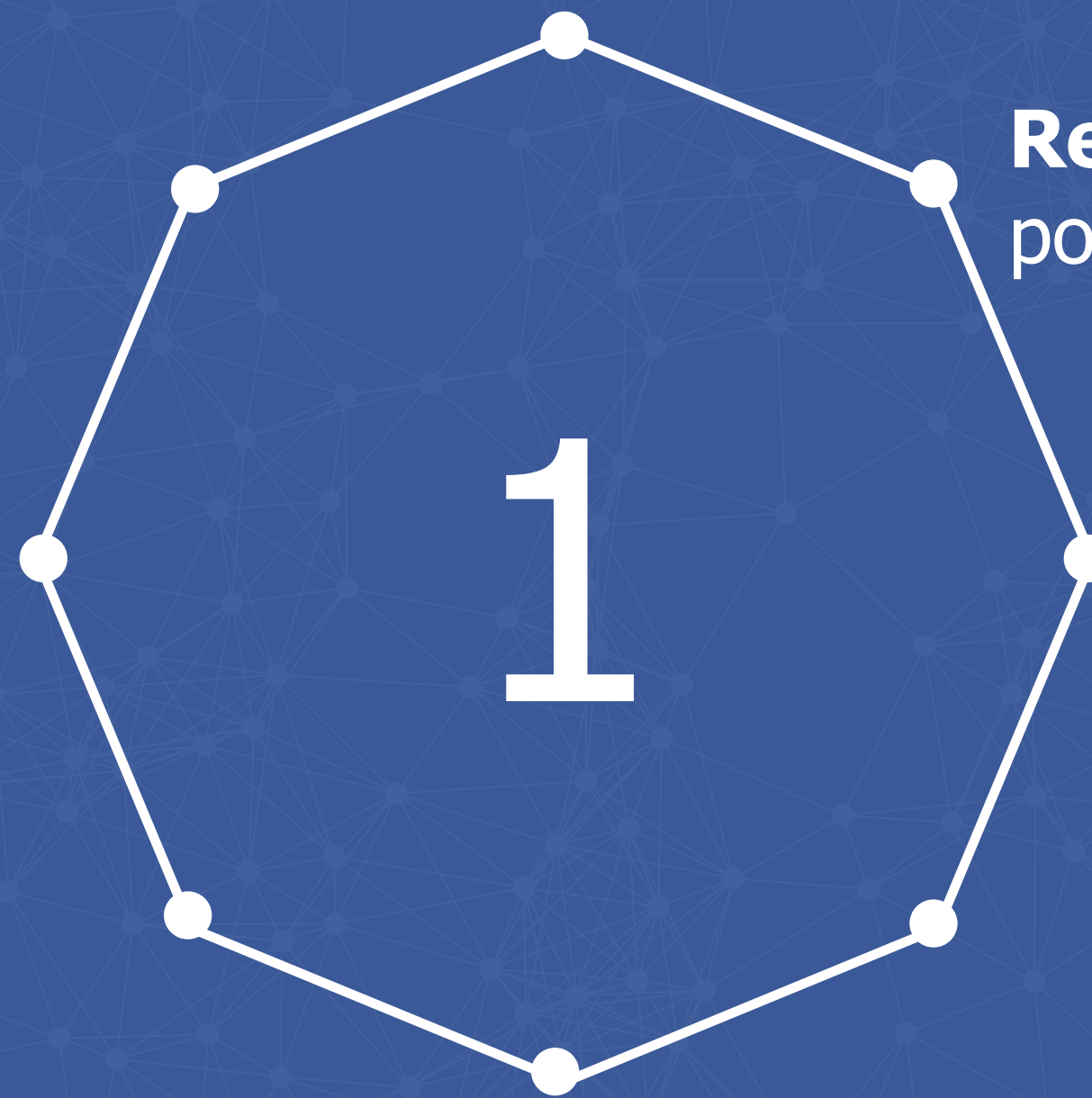




# Lessons Learned & Recommendations



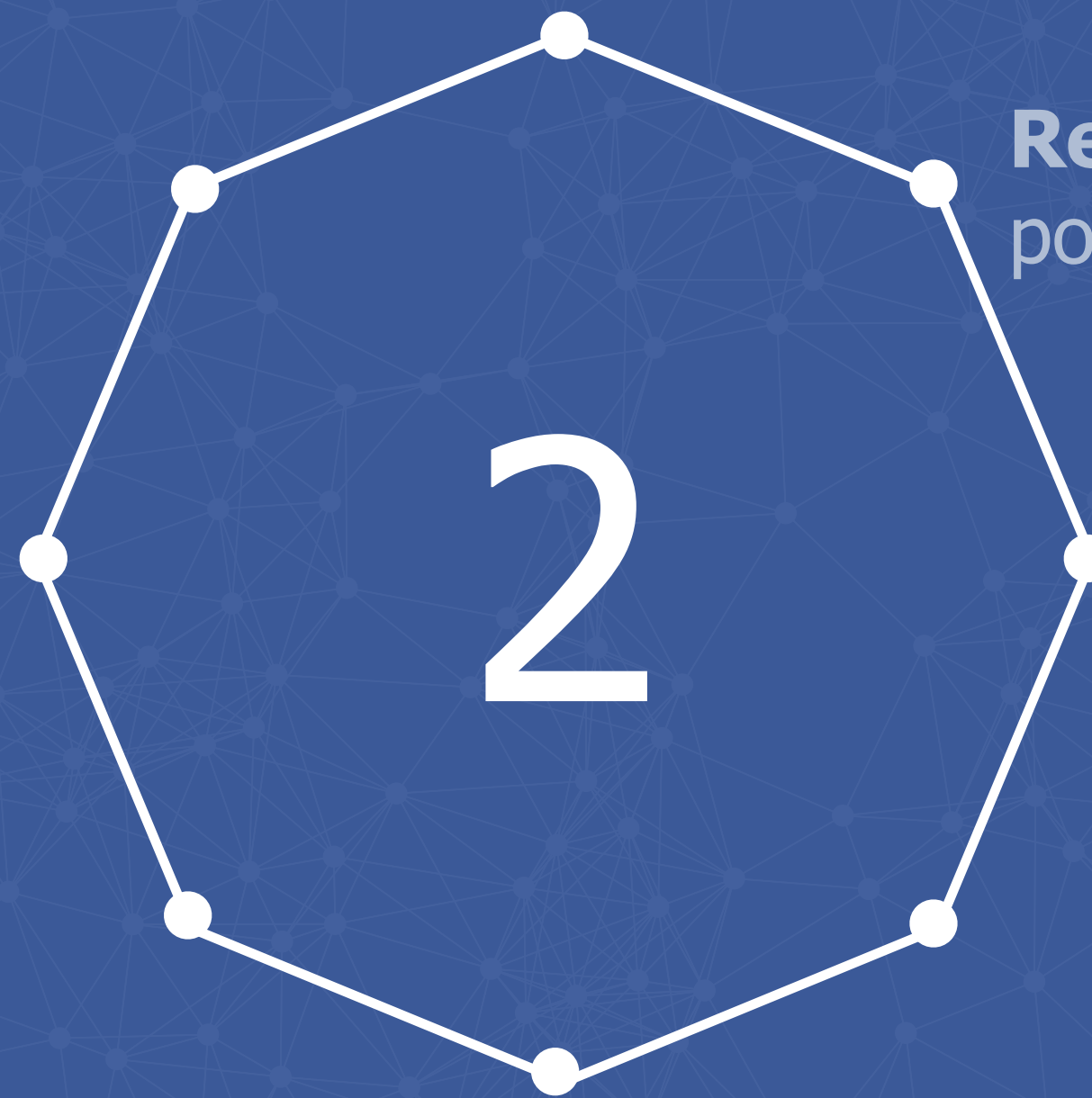
# 8 Lessons Learned & Recommendations



**Re-use** existing code/tools when possible and when it makes sense.



# 8 Lessons Learned & Recommendations

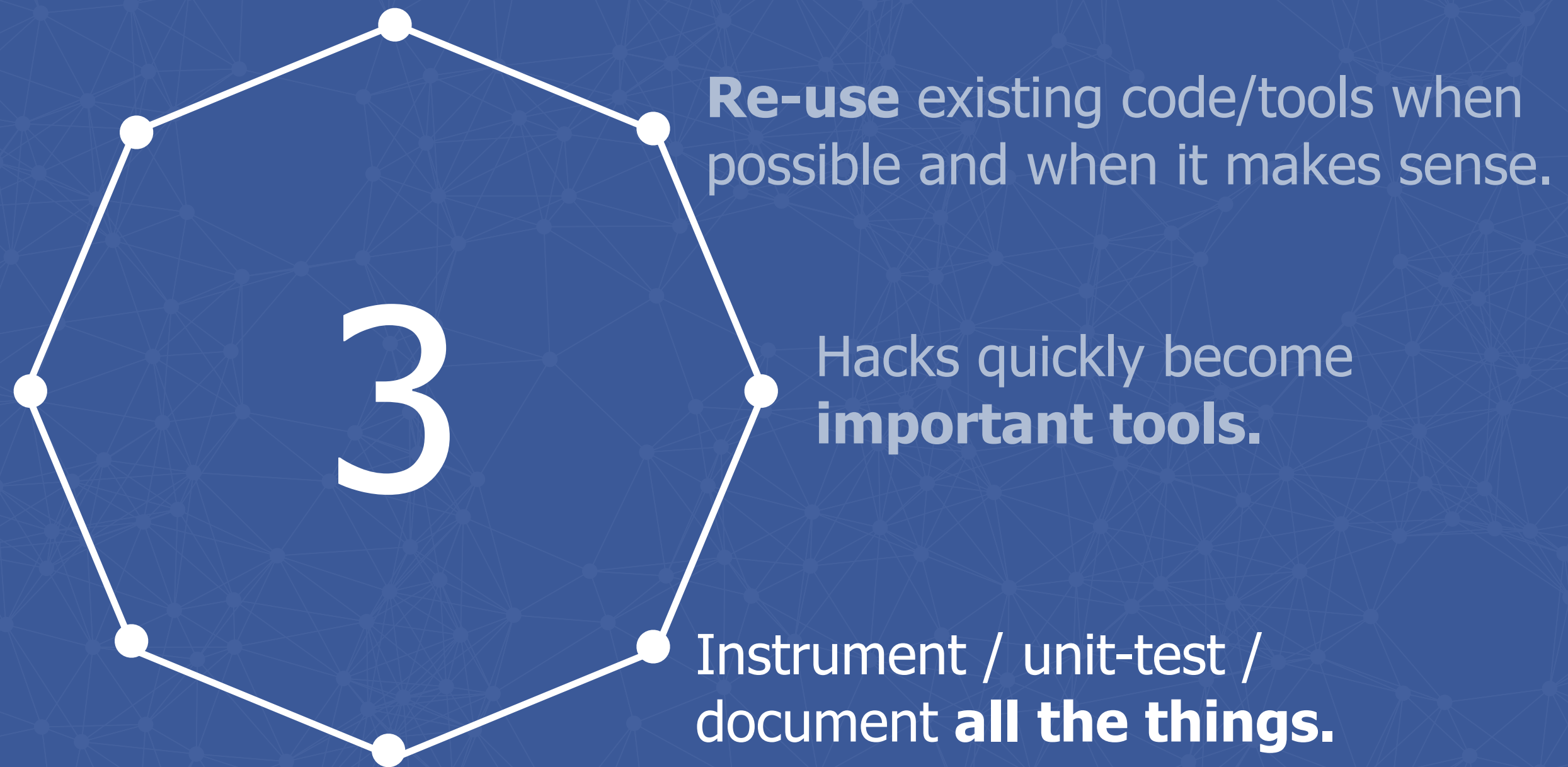


**Re-use** existing code/tools when possible and when it makes sense.

Hacks quickly become **important tools.**

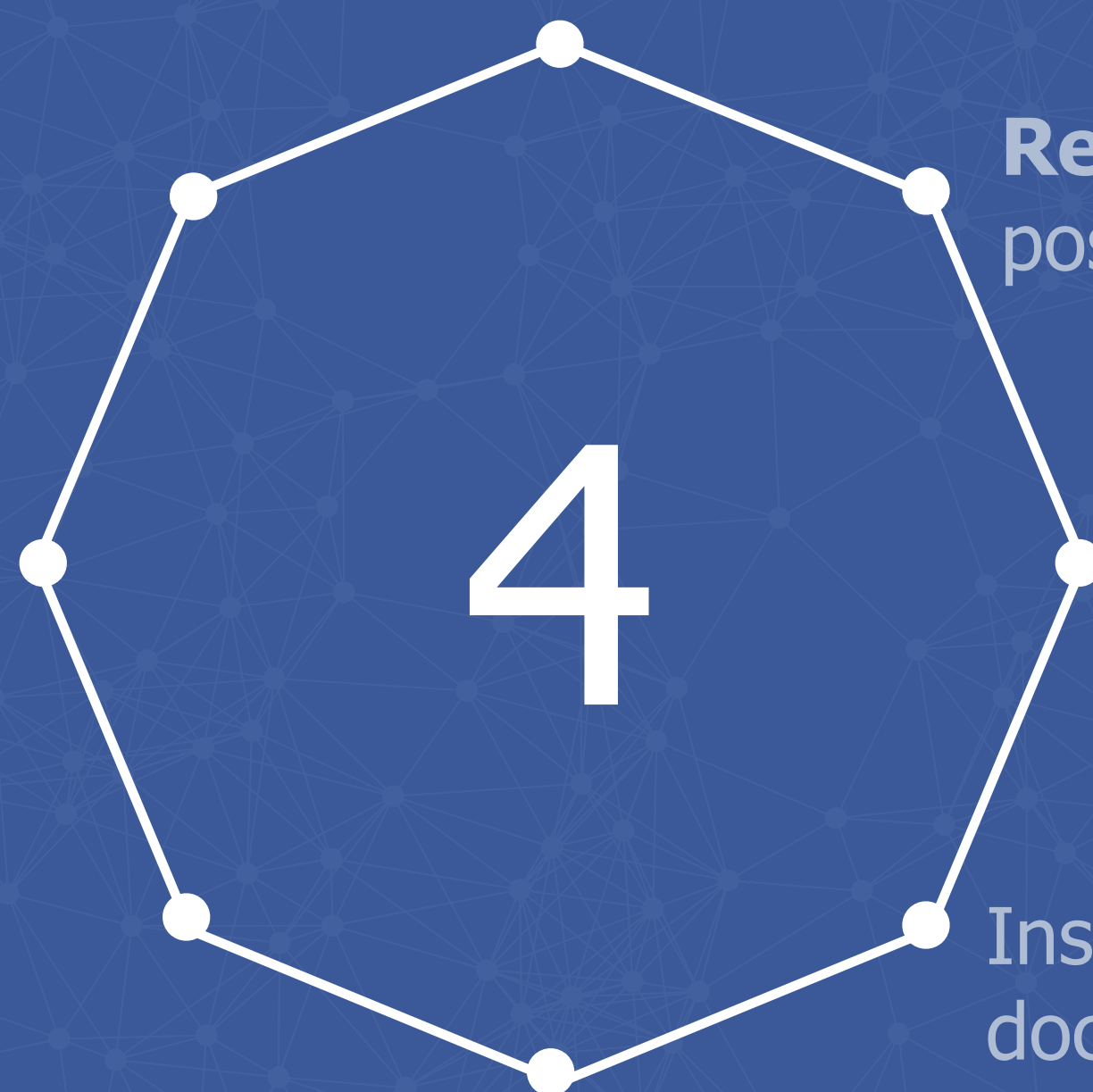


# 8 Lessons Learned & Recommendations





# 8 Lessons Learned & Recommendations



**Re-use** existing code/tools when possible and when it makes sense.

Hacks quickly become **important tools**.

Instrument / unit-test / document **all the things**.

**Poke for feedback often:** if users don't like the tool, they won't use it.

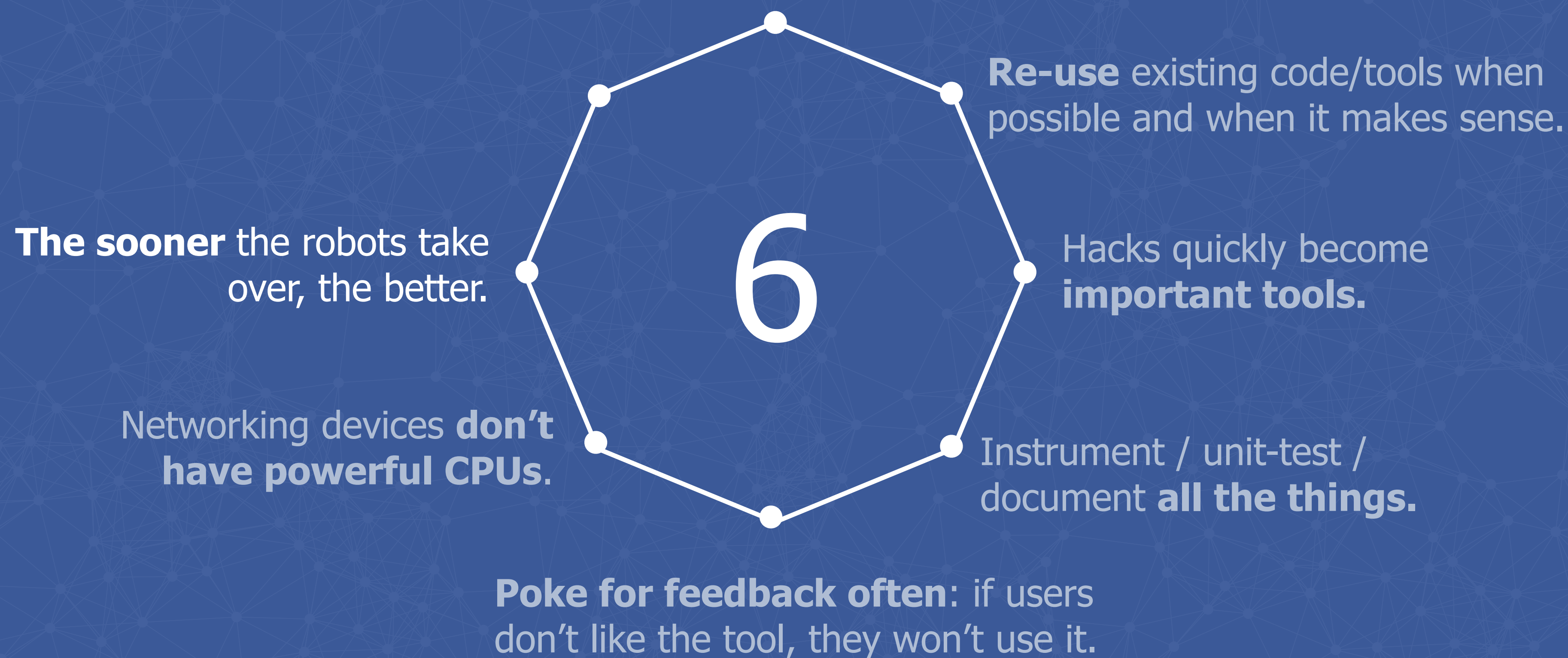


# 8 Lessons Learned & Recommendations





# 8 Lessons Learned & Recommendations





# 8 Lessons Learned & Recommendations

Talk is cheap, **focus on impact.**

**Re-use** existing code/tools when possible and when it makes sense.

**The sooner** the robots take over, the better.

Hacks quickly become **important tools.**

Networking devices **don't have powerful CPUs.**

Instrument / unit-test / document **all the things.**

**Poke for feedback often:** if users don't like the tool, they won't use it.

7



# 8 Lessons Learned & Recommendations

**Done is better than perfect!**

Talk is cheap, **focus on impact.**

**Re-use** existing code/tools when possible and when it makes sense.

**The sooner** the robots take over, the better.

Hacks quickly become **important tools.**

Networking devices **don't have powerful CPUs.**


Instrument / unit-test / document **all the things.**

**Poke for feedback often:** if users don't like the tool, they won't use it.

8



**This journey is 1% finished**



**WHAT WOULD  
YOU DO IF YOU  
WEREN'T  
AFRAID?**

FOR THE BROTHERHOOD OF THE TREE BY THE UNIVERSITY OF  
THE TREEHOUSE AND THE TREEHOUSE LABORATORY



# What's in the near future?

The journey is 1% finished



FBOSS / Wedge / sixpack  
operationalization  
improvements

Better visibility in the  
WDM space and  
correlation between the  
Optical / IP worlds

PCE

Continuous development  
of existing tools







**WHAT WOULD  
YOU DO IF  
YOU WEREN'T  
AFRAID?**

POSTER BROUGHT TO YOU BY YOUR FRIENDS AT  THE FACEBOOK ANALOG RESEARCH LABORATORY



