

You've Lost That Process Feeling

Lessons from Resilience Engineering for SRE
Dr. David D. Woods and Laura Nolan

About Dave Woods

- I have studied the phenomenon of *process feel* in many settings
- Even when I am not looking for it, I keep finding it
- I have designed computer control rooms to support it

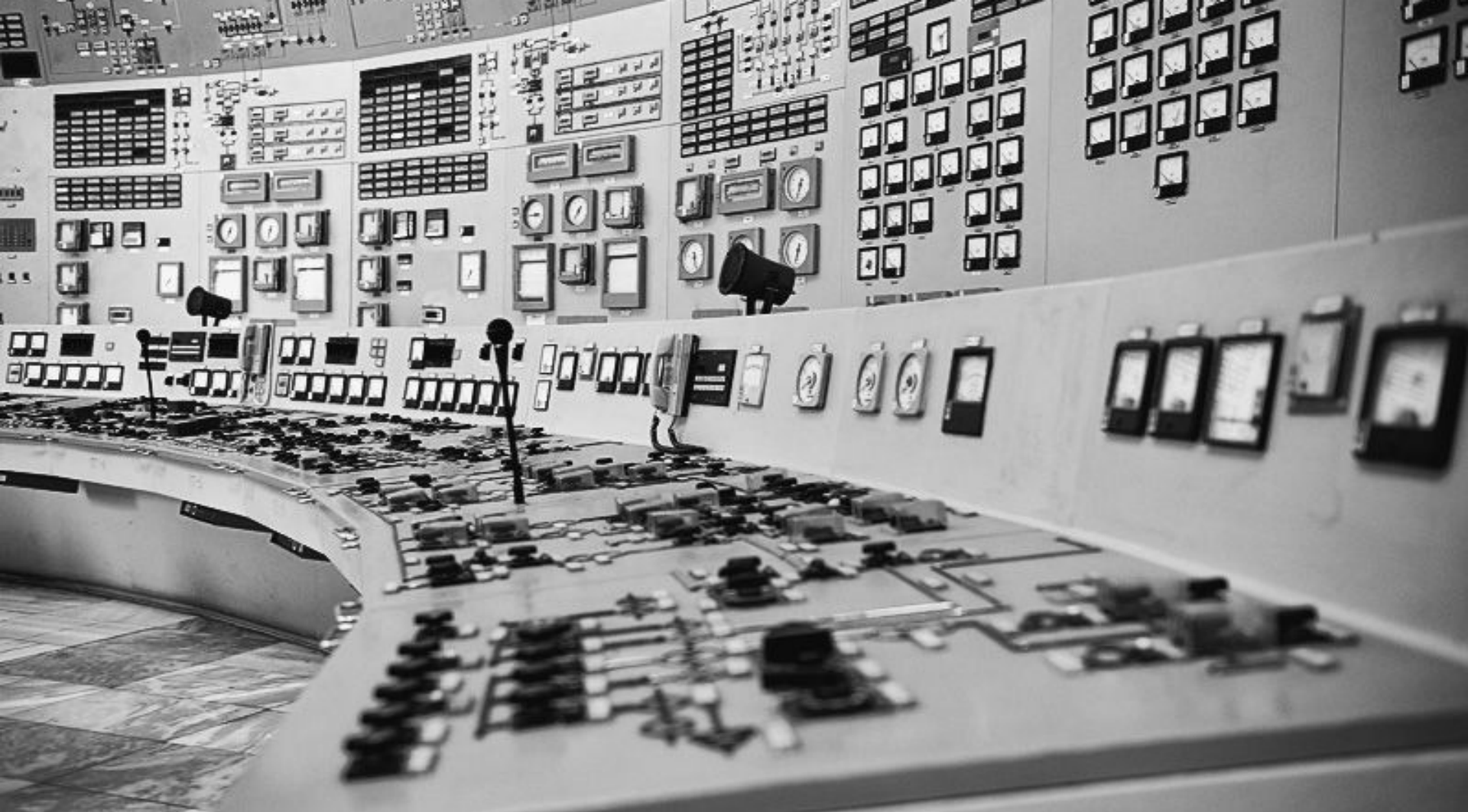
[\(PDF\) Problem detection](#)



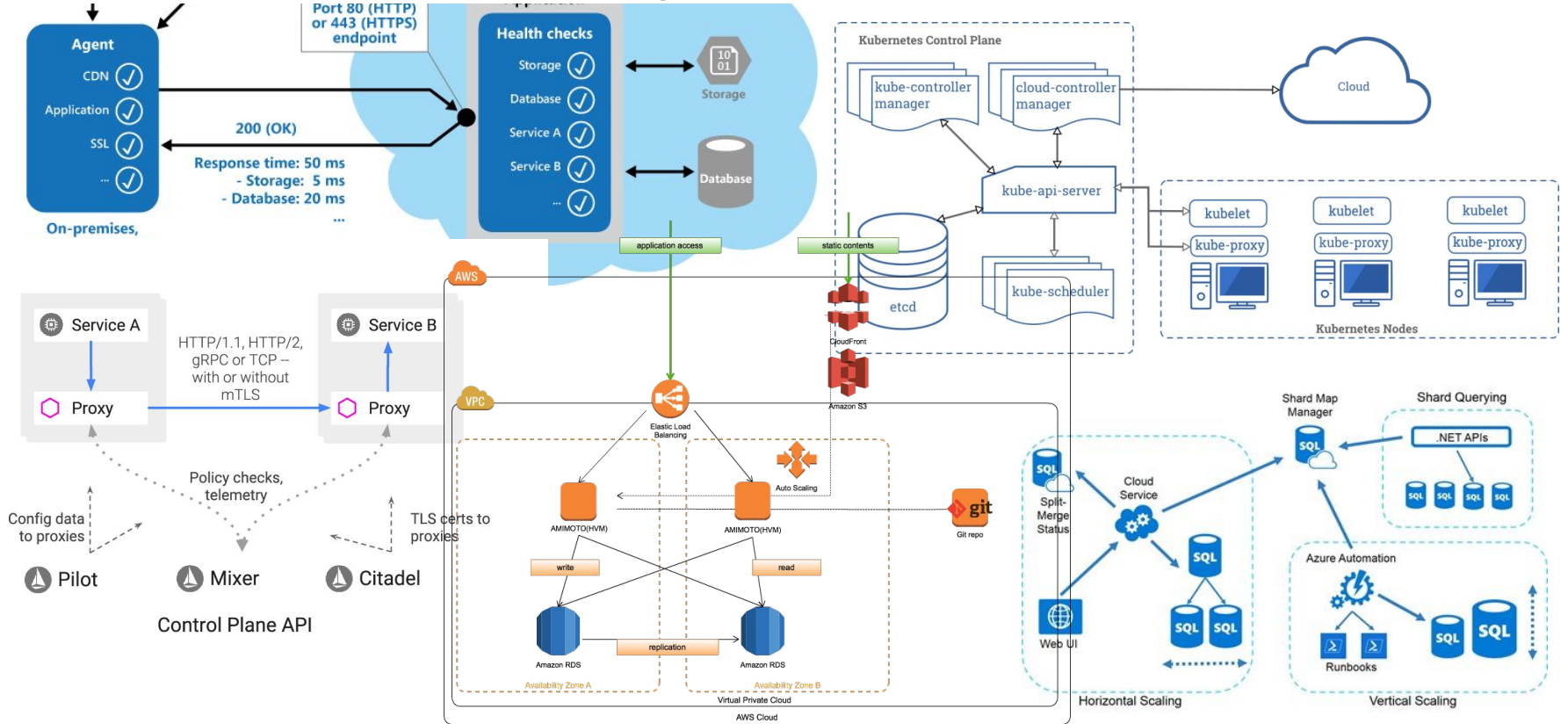
About Laura Nolan

- I've spent much of my career at the sharp end of distributed software systems, most recently at Google and Slack.
- Contributor to USENIX *login.*, the SRE book, 97 Things Every SRE should know, and more!
- Here to bridge the gap between theory and practice





Process feel in software operations





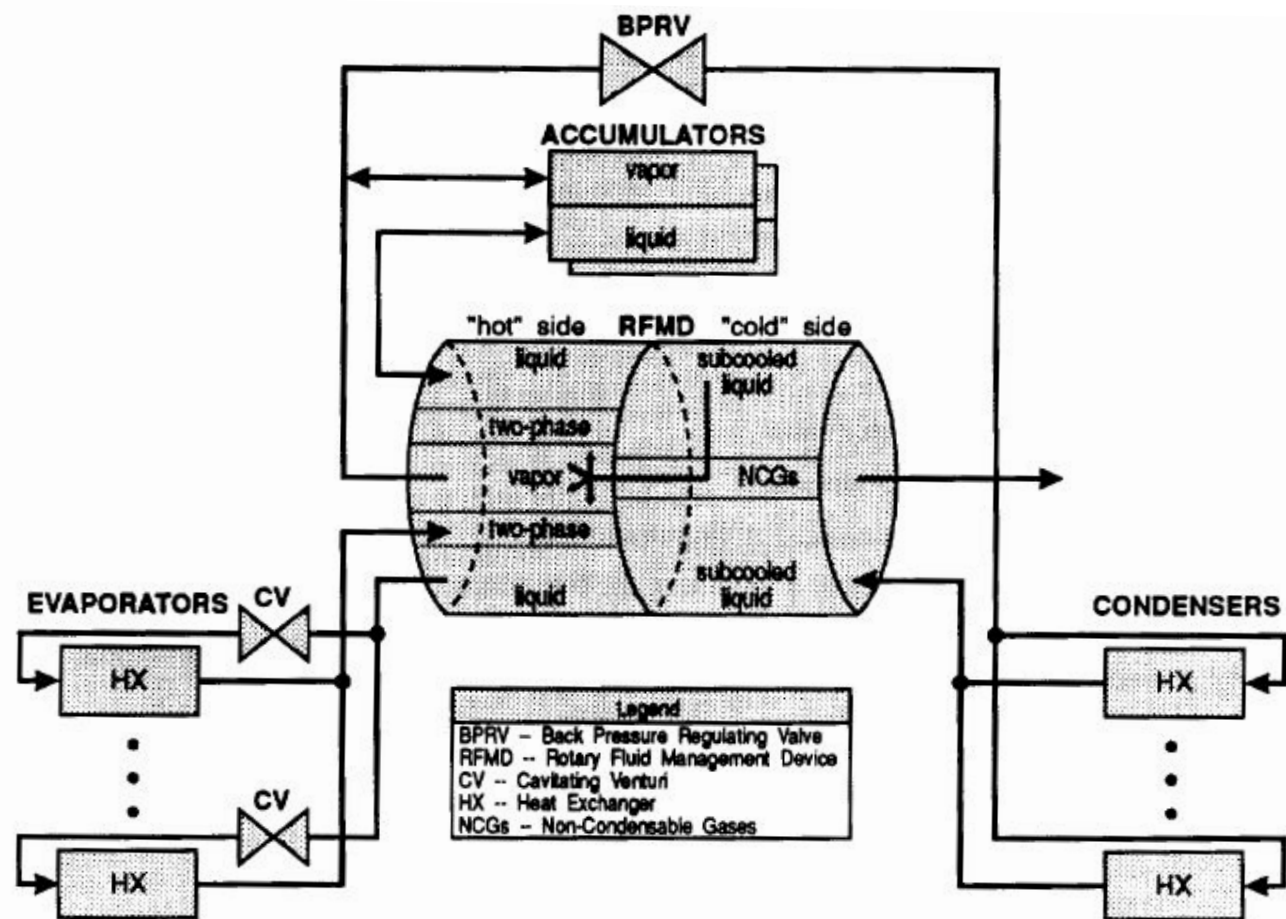
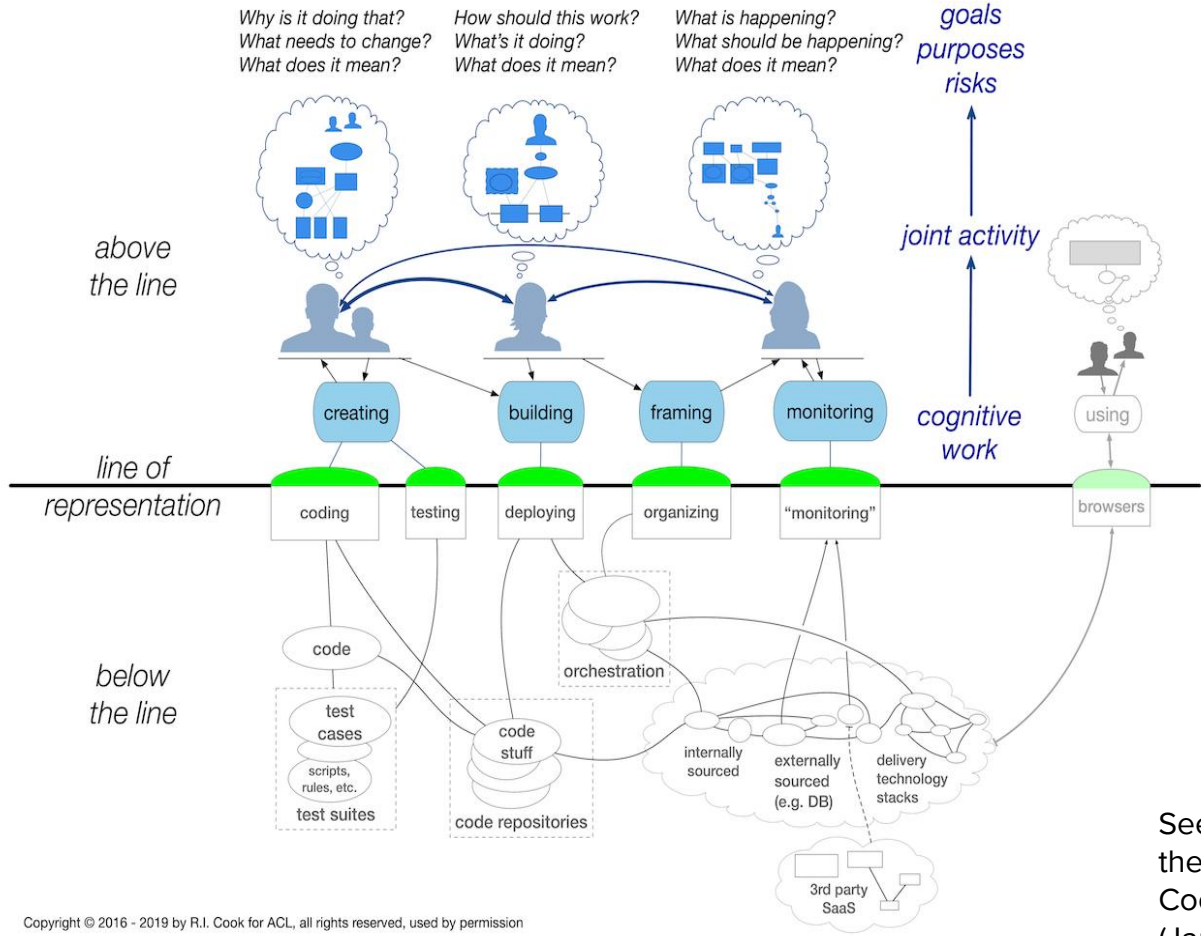


Figure 7. Thermal control system components and functional interconnections.

What makes fault management harder

- The complexities of the system (structural, functional, temporal)
- Lots of low-level metrics - these can overload the operators, who have to make sense of what they mean
- Operators often need to shift attention as events happen
- Operators have to anticipate behavior of the managed process



See 'Above the Line, Below the Line' by Richard I. Cook, M.D., *ACM Queue* (Jan 2019).

Three factors that help in handling anomalies

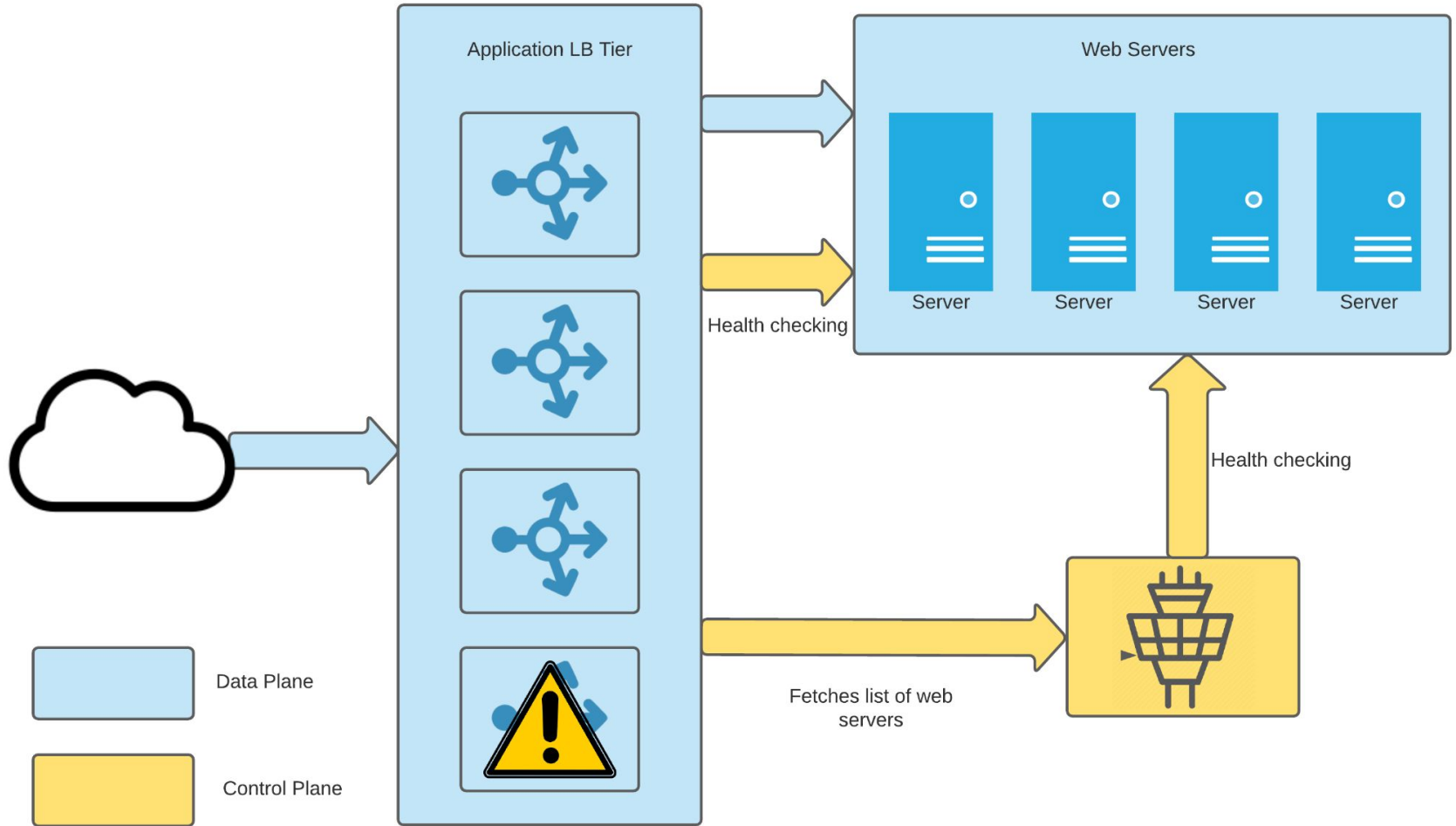
- Process Feel
- High-Signal Alerts
- Graceful Extensibility

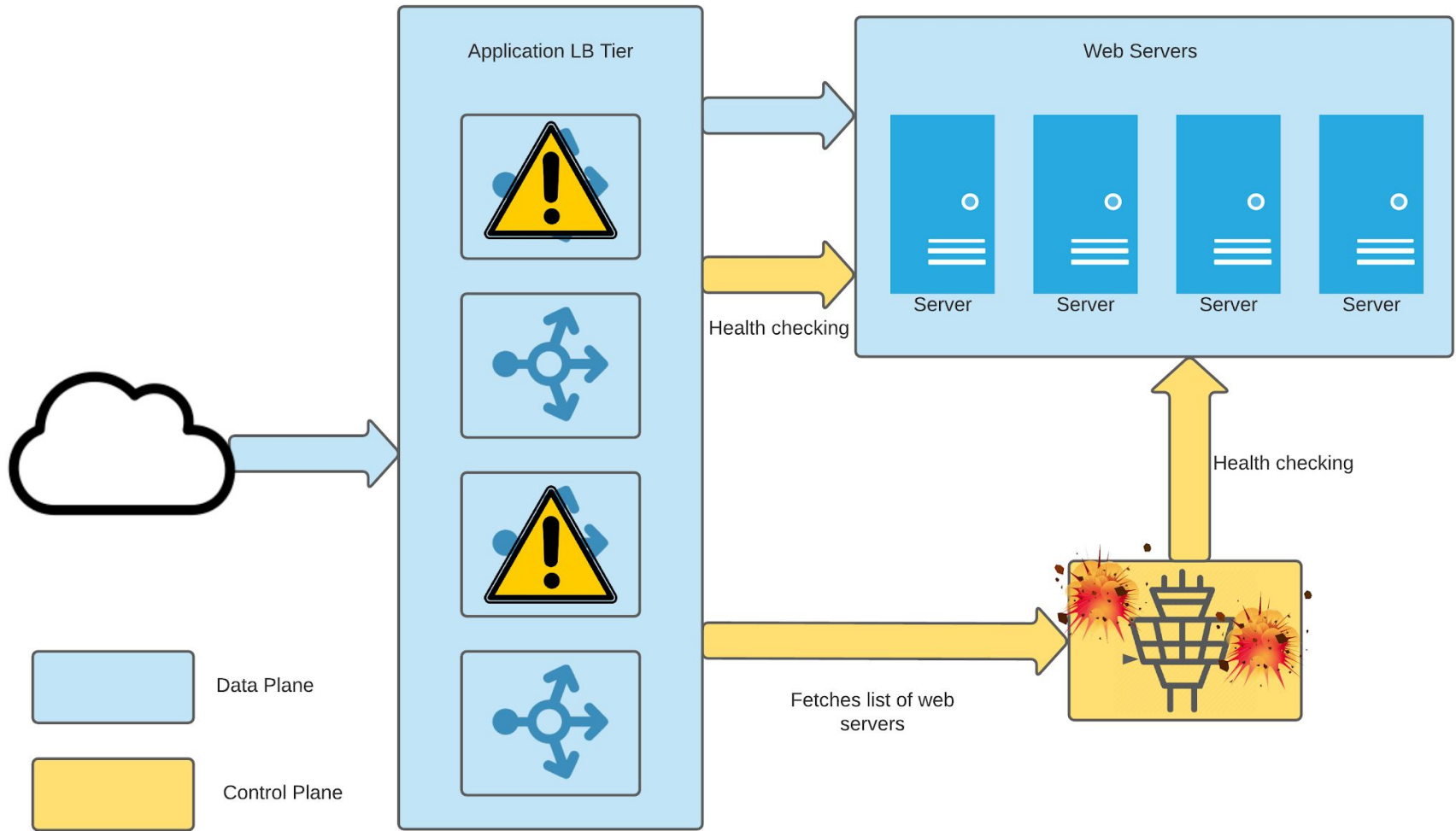
Alerts are not a panacea

- The 'Dark Board': everything is fine until it isn't
- Effects at a distance in complex systems
- Alert overload: we've all been lost in rapidly increasing numbers of alerts

Once upon a time









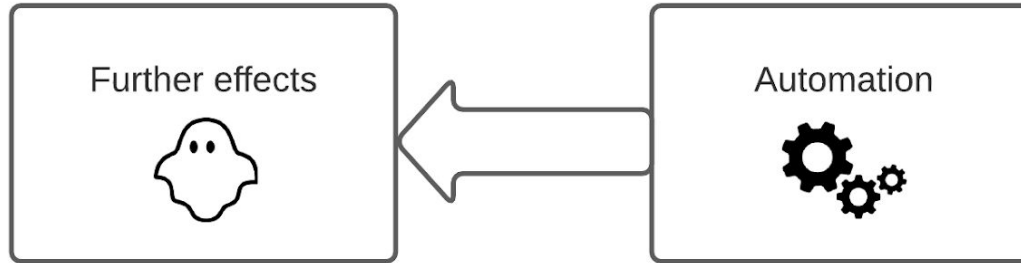
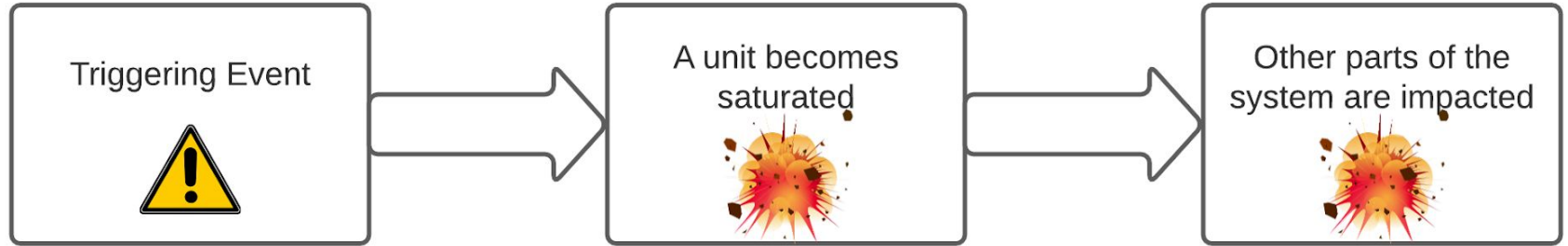
This story will be continued...

Graceful Extensibility and Overload

What parts of a system are approaching saturation?

How their response spreading overload?

Local behavior pushes
load elsewhere



Mechanisms such as
scaling kick in,
complicating the
picture

System behaviour approaching overload

Current systems tends toward:

- Late responses
- Large responses
- Responses that dump overload elsewhere
- Automatic provisioning/deprovisioning mechanisms with low sensitivity

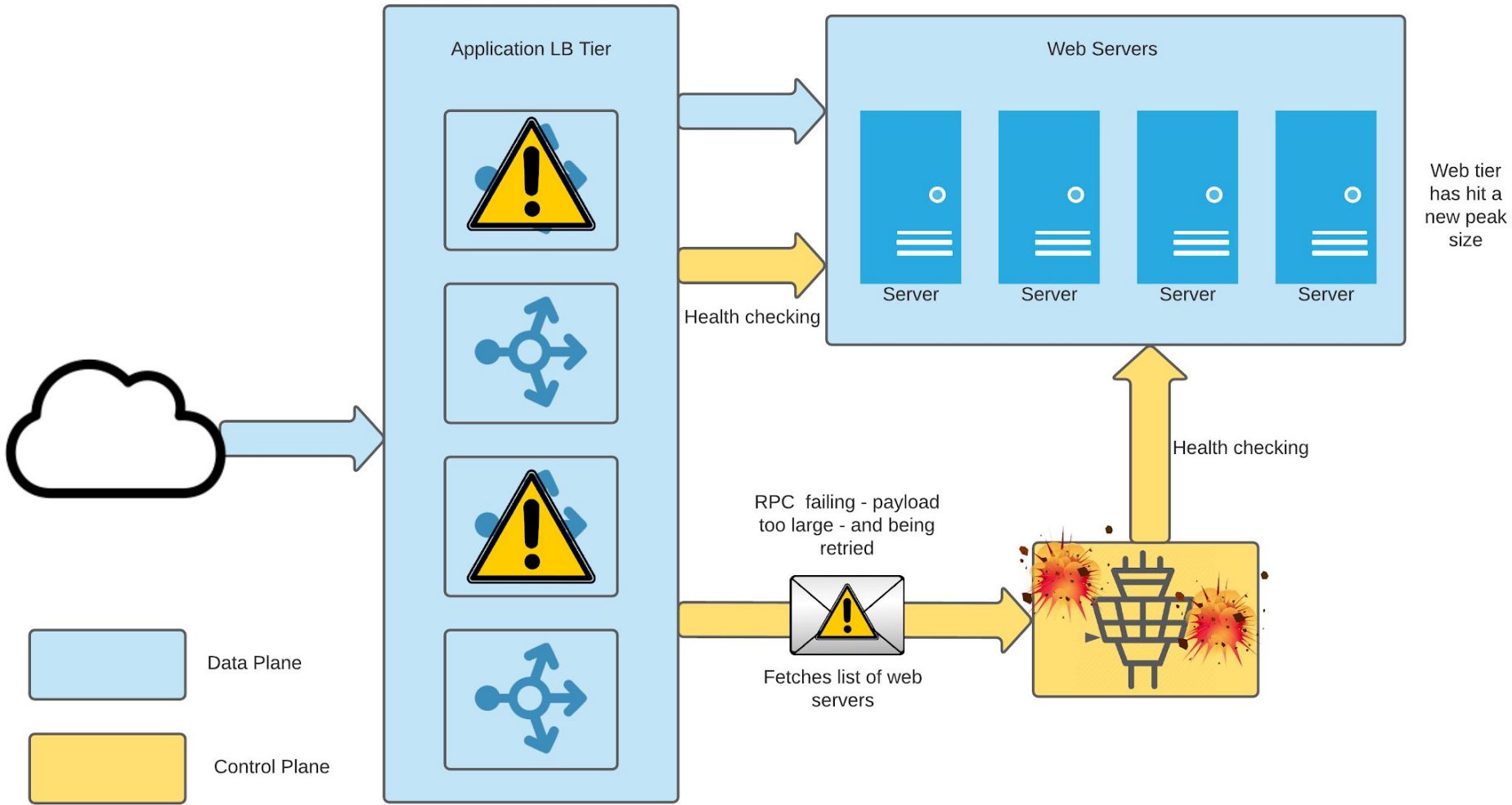
Theory of Graceful Extensibility

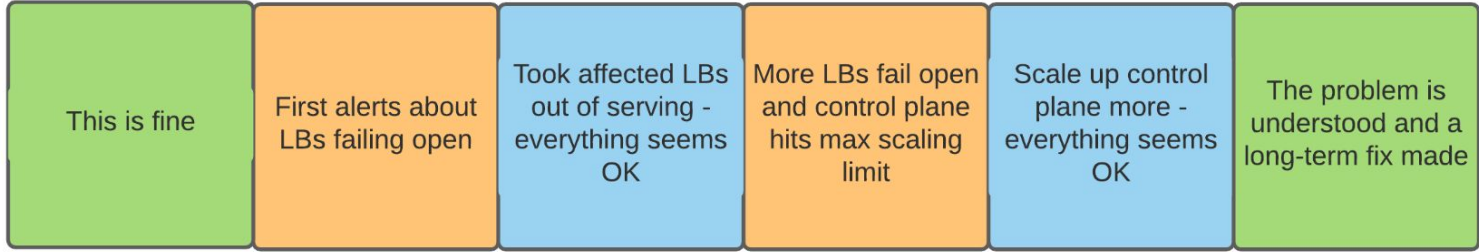
Graceful Extensibility provides guidelines for designing how automated functional units should behave when approaching saturation.

- All parts of your system have a limit on their adaptive capacity, and you must have a strategy to manage challenges
- Your system is connected - you need to manage behaviour in overload across interconnected units, in a dynamic way
- No part of your system can have full knowledge of the entire system - but connected parts can 'signal' their neighbors to adapt to conditions

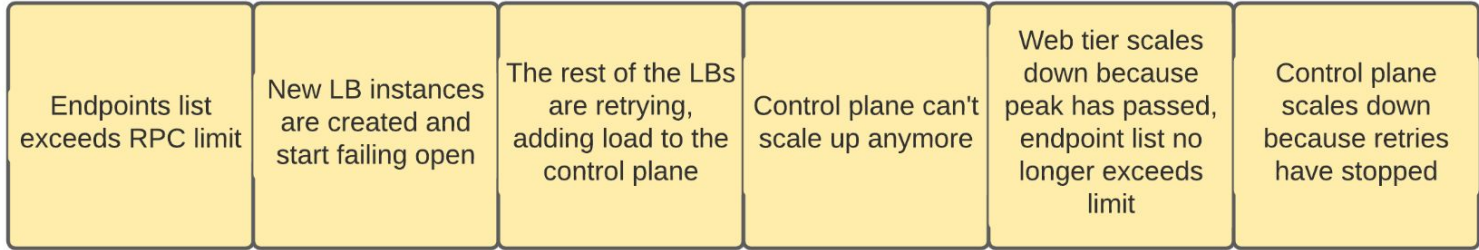


Back to our story





Operator observations and actions



What was happening under the hood



Takeaway: Value Process Feel

- It's central to monitoring networks of highly autonomous units
- It requires investment
 - Avoid siloing
 - Share knowledge regularly
 - Do practical training and disaster tests
 - Expose state in system status pages, consoles - not only logs and dashboards
- Can't measure process feel directly - consider surveys
- Humans are part of your system - process feel makes your humans more effective

Take Away: Level Up Your Alerts

- Alerts are weak, low level & fragmented.
- They require a lot of cognitive work to make sense of developing incidents.
- Go beyond thresholds
 - Think about relationships and constraints
 - Dynamic values - like percentages of a related value - are better than static values
- Practical examples:
 - Control loops aren't completing in the expected timeframes
 - Circuit-breaking or loadshedding are occurring
 - Resources are saturated

Takeaway: Apply the Theory of Graceful Extensibility

In interconnected systems, by default, behavior under load will be brittle

By paying attention to behaviour when approaching saturation, and by thinking about the system as a connected whole, brittleness can be reduced.

References

- [Revealing the Critical Role of Human Performance in Software](#)
- [The Discovery of Graceful Extensibility Reframes the Pursuit of Autonomy & Addresses the Brittleness Problem \(YouTube\)](#)
- [The Theory of Graceful Extensibility: Basic rules that govern adaptive systems](#)
- [4 Essentials of resilience, revisited](#)
- ['Anomaly Response' in *Joint Cognitive Systems: Patterns in Cognitive Systems Engineering*](#)
- [Cognitive demands and activities in dynamic fault management: abduction and disturbance management](#)