Software Security as a Force of Nature

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StaffPlus New York 2024

Do we want to deliver secure software?

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Why is software security so difficult?

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World is not nice.

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- World is not nice
- Constant change
- Flaws are *so* common
- Maintenance is continuous
- Procedures don’t match conditions
- Production pressures unbalanced
- New hazards appearing

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Software cyberorthodoxy assumes the world is nice: closed and linear. That's why it fails.

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If world not nice, what do instead?

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In nature, organisms thrive by pursuing a strategy we refer to as resilience.

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Our software has predators (attackers), too

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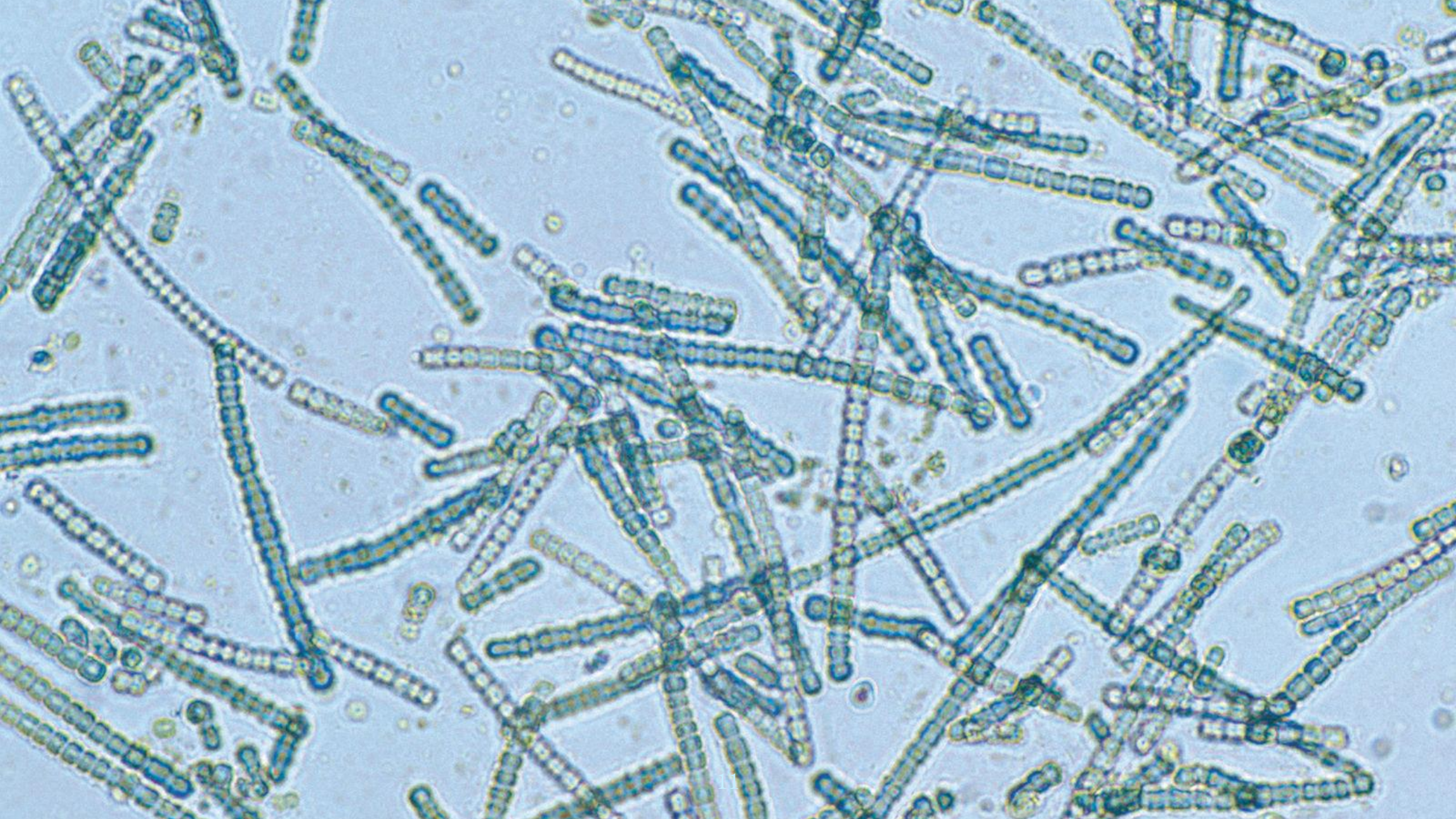
Defensive adaptations in nature emerge from successful evasion; only the outcome matters

Source: Steve Harvey



Adaptation is emergent; software security changes should emerge from other initiatives

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Let’s extend our patterns & practices to apply “natural” defenses to software...

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Source: Taylor Chausky


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In a similar fashion, we can repurpose automation like CI/CD and IaC for security.

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With IaC, we generate the same environment every time for reliable & predictable services.

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- faster incident response
- minimized misconfigurations
- faster patching + security changes
- minimized environmental drift
- catching vulnerable configs
- stronger change control

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CI/CD enforces invariants: properties we want every time we build + deploy + deliver

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“Services must communicate over TLS and validate remote certificates.”

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“Only images built by our CI/CD system may run on the production Kubernetes cluster.”

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Source: Julian @PhotasticLab

Caching more content makes us more resilient to Layer 7 DDoS attacks

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Source: Andrey Tikhonovskiy

We can make our systems immutable as a form of temporal amputation (ie isolation).

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Time-based access tokens are another form of temporal isolation that frustrates attackers

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Life quite literally emerged due to isolation.

Nature was the original architect of nested isolation, long before we made the transistor.

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Sources: ANIRUDH; Kate Storey & Marios Stavridis (Wellcome Collection); Robina Weermeijer; Joe Green; Guillermo Ferla

Modularity is a system property reflecting the degree components can be decoupled.

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Allows distinct parts to retain autonomy during stress & easier recovery from loss

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Source: UNESCO

We should similarly treat modularity and isolation as essential for software.

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Isolation is an invisible foundation of your lives as software engineers.

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We want to make security invisible, too.

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In nature, adaptation does not involve reinventing from scratch; it involves iteration using common components.

Source: National Cancer Institute

We can standardize middleware like authN so we don’t have to think about it.

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Source: Landon Martin

We must adopt deception in software more.

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Agility and stamina help prey evade predators, like gazelles vs. cheetahs.

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Source: Hu Chen (Unsplash)

We should keep software components small and nimble so they can “evade,” too

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Source: Lorna Ladril

We should similarly use autoscaling against attackers for availability resilience.

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Source: Shannon Potter

Adopting ephemerality similarly introduces unreliability against attackers.

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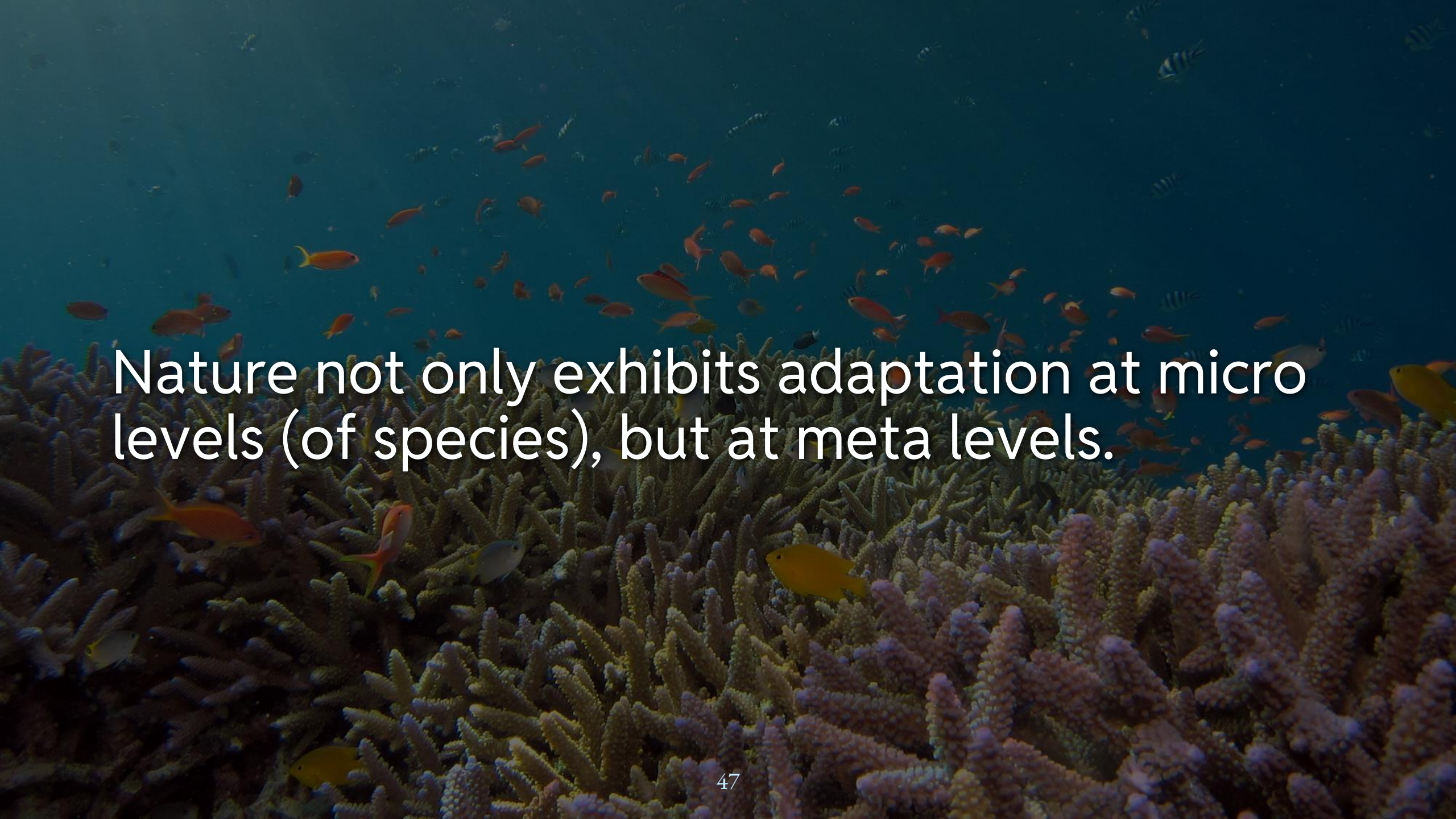
Nature not only exhibits adaptation at micro levels (of species), but at meta levels.

Life is cyclic, not linear; we must replenish soil and deadhead blooms to nourish growth.

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Our software must prepare for, recover from, and adapt to (corporate) cycles.

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Functional diversity is a critical factor for resilience in ecological systems.

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Flask
web development, one drop at a time
ANSIBLE
kafka
GitHub
Symfony
django
JUnit
redis
RAILS
OPENSHIFT
amazon S3
OpenSSL
Cryptography and SSL/TLS Toolkit
Couchbase
authentik
LOG4J
fastly
incident.io
APACHE HTTP SERVER PROJECT
Maven
MySQL
CHEF
replit
GitLab
Grafana
puppet
ClickHouse
spring
new relic
SALT PROJECT
HIVE
elastic
Kong
AWS CLOUDFORMATION
netlify
splunk>
NumPy
VMware Tanzu
Avro
Parquet
protobuf
Google Cloud Deployment Manager
cassandra
kubernetes
docker
Bamboo
fluentd
SQLite
Google Kubernetes Engine
presto
Amazon EKS
pandas
CLOUDFOUNDRY
Istio
HELM
gRPC
curl://
AXIOS
Terraform
envoy
DATADOG

Swappability is inherent in functional diversity (like blackbirds vs. thrashers).

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We desperately need swappability (easy substitutions) in software systems.

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Source: Traci O’Connor

Only collect data with a clear purpose.

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FD reflects true redundancy: the system has multiple paths to reach a goal outcome.

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Life, uh, finds a way. And we can, too.

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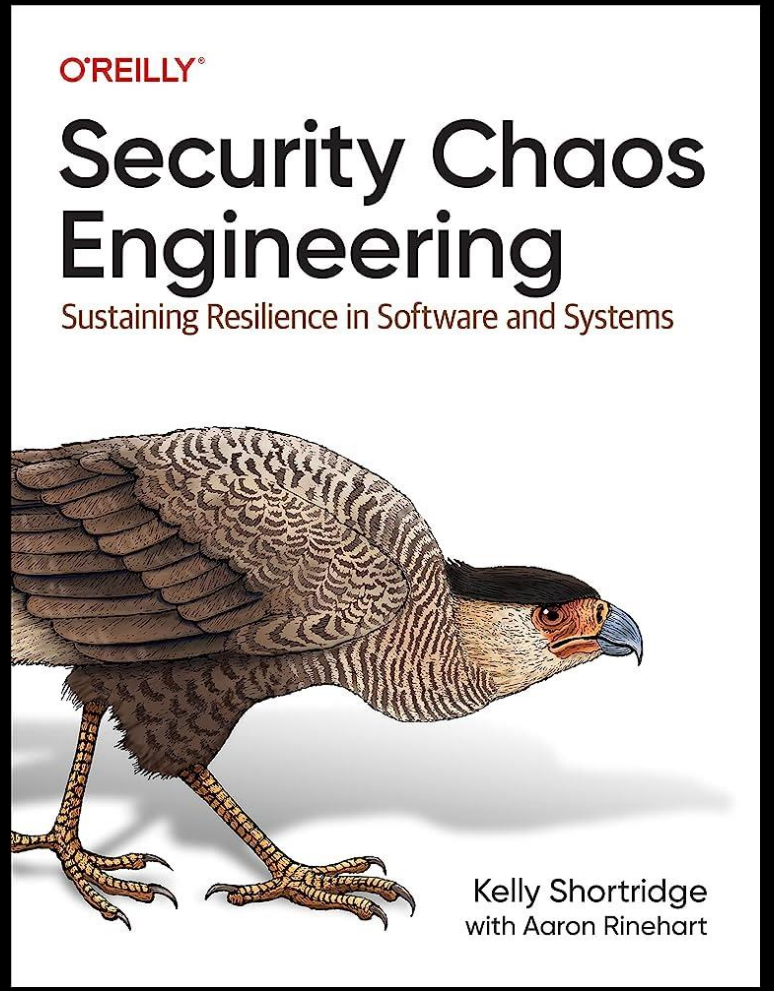

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