Mirrors, networks, and boundaries: what technical leaders need to know for the next 10 years of devops

Lindsay Holmwood
10 years
Sensitive dependence on initial conditions
What were the initial conditions?
Post-GFC

scarcity
Organisations were requiring increased operational tempo
Siloisation was becoming a less viable organisational strategy
Infrastructure was becoming commoditised & on-demand
Barrier of entry to dev tools had been lowered
The last 10 years
Three lenses:

Delivery
Systems
People
Operating models

Before Waterfall
Operating models

After Agile, Lean
Devops started as “agile systems administration”
Deploy frequency

Before
Weekly-to-monthly deploys
Deploy frequency

After

Multiple deploys a day
Continuous Delivery is the standard in web industry.
Systems
Infrastructure

Before

Blend of:

◦ bare metal + virtualised
◦ on-prem or “hosting”
Infrastructure

After IaaS, PaaS
Commodification of infrastructure
Infrastructure management

Before Scripting
Infrastructure management

After

Powerful config management
Architecture

Before Monoliths

Systems
Architecture

After Microservices
Is this reality or aspirational?
Deployment unit

Before Virtual machines
Deployment unit

After Containers
Deployment unit

Future Functions?
How we respond to failure

Before Blame culture
How we respond to failure
After
Just culture
Blameless post-mortem
Relationships to our co-workers

Before Silos
Relationships to our co-workers

After Empathy
Build DevOps culture through shared experiences
Devs on call
+
Ops shipping code
Organising around the deployment pipeline
What’s next?
“Prediction is very difficult, especially about the future.”

– Niels Bohr
I’m not going to make predictions
Yes, but it’s not necessarily a bad thing.

As long as the technology is an enabler of the underlying principles (communication, collaboration, a holistic view), the DevOps movement is still sound.
What are the conditions now?
The DevOps dream ain’t evenly distributed
Accelerate: State of DevOps
Strategies for a New Economy
...the overall industry is improving its software development and delivery practices
...low performers are struggling to keep up, widening the gap
Increasing, fragmented regulation
○ GDPR
○ NDB + APP
○ “the Netflix tax”
Good for society, a PITA for us
ALGORITHMIC IMPACT ASSESSMENTS:
A PRACTICAL FRAMEWORK FOR PUBLIC AGENCY ACCOUNTABILITY

Dillon Reisman, Jason Schultz, Kate Crawford, Meredith Whittaker

APRIL 2018
Frameworks for accountability
Custom ASICs are proliferating.
Machine learning is becoming more accessible
Google Neural Machine Translation

Source: NYT – The Great AI Awakening
Generative adversarial networks
Let’s talk about skills for managing uncertainty & ambiguity
Mental models for:
- Understanding culture
- Harnessing mirroring
- Mapping strategy
- Managing risk
Understanding culture
We don’t know shit about culture
Schein’s three levels of culture
Artifacts

Values

Assumptions
Artifacts
physical manifestations of culture
ceremonies
desk layout
static int __init procfs_init(void)
{
    // new entry in proc root with entry point
    proc_rtkit = create_proc_entry(
        if (proc_rtkit == NULL) return 0,
        proc_root = proc_rtkit->parent;
        if (proc_root == NULL) return 0;
    }
    proc_rtkit->read_proc = rtkit_read;
    proc_rtkit->write_proc = rtkit_write;

MODULE INIT/EXIT
static int __init rootkit_init(void)
if (!procfs_init()) { } fs_init() { fs_clean();

software
most visible parts of an org’s culture
easiest part of a culture to adopt
Values
conscious goals, strategies, and philosophies
rules that guide how we interact with people
rules that guide how we do our work
“we will dominate the market”
“management is available, and listen to our concerns”
“we value quality over delivery speed”
“nobody will be fired for making an honest mistake”
values:
lived
vs
aspirational
Communication

We have an obligation to communicate.
Respect
We treat others as we would like to be treated.
Integrity
We work with customers and prospects openly, honestly, and sincerely.
Excellence
We are satisfied with nothing less than the very best in everything we do.
We conduct business affairs in accordance with all applicable laws and in a moral and honest manner.
Work as imagined
vs
Work as done
Be clear about what values are what
Assumptions
beliefs, perceptions, thoughts, feelings
exist at an unconscious level
hard to discern
“anyone can take on leadership responsibility”
“bad outcomes come from bad people”
“it’s OK to withhold information”
“individual performance is valued over team performance”
“we can trust that team”
Our systems are artifacts
Our processes are artifacts
Tools are a snapshot of our org’s culture
Tools are a snapshot of our org’s values and assumptions
Artifacts influence behaviour
Encode the org behaviour you want to see into your artifacts
Change your org’s values by changing your artifacts
Artifact:

All changes go through a CD pipeline.
Value:

We create fast feedback loops to learn from changes in production.
Artifact:

Developers and managers do on-call
Value:

Performance, availability and sustainability are everyone’s responsibility
Artifact:

Our ceremonies include and engage non-technical disciplines
Value:
Nobody has all the answers. We succeed by working together.
But the tools are only a means to an end.
The goal is transforming our ways of working
EDGAR H. SCHEIN

ORGANIZATIONAL CULTURE AND LEADERSHIP

4TH EDITION
Harnessing mirroring
"Organizations which design systems are constrained to produce designs which are copies of the communication structures of these organizations."

– Melvin Conway
“In a complex system, the technical architecture and the division of labor will “mirror” one another in the sense that the network structure of one will correspond to the structure of the other.”
Two separate research traditions studying mirroring
1. Computer science
Conway’s law
2. Management
Org + product design & orgs + products as complex systems
What is mirroring?
Two networks
Organisational
Technical
Organisational Technical Mirroring
We do this to solve problems
We do this to take people to where the problems are.
Who owns this system?
We do this because it’s economical
Organization design: an information processing view

Galbraith, 1974
As uncertainty increases, the amount of information that must be processed by decision makers increases.
The org can respond by reducing the need to process information.
The org can respond by increasing the capacity to process information.
4. Creation of Slack Resources

5. Creation of Self-Contained Tasks

Reduce the Need for Information Processing

FIGURE 1. Organization Design Strategies
Creation of lateral relations:
- Direct contact
- Liaison roles
- Task forces
- Teams
- Integrating roles
- Managerial linking roles
- Matrix organisation
Creation of lateral relations: Matrix organisation Teams

- Technical authority over the product
- Formal authority over the product (in product organization, these relationships may be reversed)
Creation of lateral relations: Matrix organisation

Teams
Why do we stop at dev and ops?
We can also include:

- support
- marketing
- design
- analytics
- legal
- finance
What happens if we don’t?
This paper demonstrates that the traditional categorization of innovation as either incremental or radical is incomplete and potentially misleading and does not help firms understand the sources of competitive advantage in the sustainable growth of the semiconductor industry. We illustrate the concept’s explanatory force through an empirical study of the semiconductor photolithographic alignment equipment industry, which has experienced a number of architectural innovations.
Architectural Innovation: This paper demonstrates that the traditional categorization as either incremental or radical is potentially misleading and does not always capture the sometimes disastrous effects on industry and technology. The study of seemingly minor improvements in technology, such as innovations that are more incremental than radical, often means that the components of a product are integrated into the system. If the architectural innovations can define a product without making architecture an integral part of the firm, then it is clear that the architectural innovation presents challenges that may have significant competitive implications. We illustrate the concept’s explanatory force through an empirical study of the semiconductor photolithographic alignment equipment industry, which has experienced a number of architectural innovations.
The core of the data is a panel data set consisting of research and development costs and sales revenue by product for every product development project conducted between 1962, when work on the first commercial product began, and 1986. This data is supplemented by a detailed managerial and technical history of each project. The data were collected through research in both primary and secondary sources. The secondary sources, including trade journals, scientific journals, and consulting reports, were used to identify the companies that had been active in the industry and the products that they had introduced and to build up a preliminary picture of the industry’s technical history.
4 waves of innovation between 1962-1986

Table 1

<table>
<thead>
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Source: Field interviews, internal firm records (Henderson, 1988).
4 waves of innovation

- New leader after each wave:
  - Kulicke
  - Perkin-Elmer
  - Kasper
  - GCA
  - Nikon

Source: Field interviews, internal firm records (Henderson, 1988).

Introduction of 'site-by-site' alignment, larger 5x lenses.

Throughput now driven by calibration and stepper stability.

Relationship between lenses and mechanical system becomes crucial means of controlling distortion.

Critical relationships between components:
- Accuracy and stability of gap is a function of links between lens and other components.
- Depth of focus characteristics — driven by relationship between source wavelength and lens numerical aperture — become critical. Interactions between stage and alignment system are critical.
4 waves of innovation
each incumbent
could not course correct

A Summary of Architectural Innovation in Photolithographic Alignment Technology

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Source: Field interviews, internal firm records (Henderson, 1988).
4 waves of innovation
each incumbent invested heavily in new technology

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<th>Details</th>
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Source: Field interviews, internal firm records (Henderson, 1988).
4 waves of innovation
each incumbent
structured organisation
and communication
based on product architecture

| Second-generation stepper | Introduction of "site-by-site" alignment, larger 5x lenses. | Throughput now driven by calibration and stepper stability. Relationship between lens and mechanical system becomes crucial means of controlling distortion. |

Source: Field interviews, internal firm records (Henderson, 1988).
### 4 waves of innovation

What about this makes sense?

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Source: Field interviews, internal firm records (Henderson, 1988).
Henderson & Clark’s framework for defining innovation

Based on Schumpeter, 1942

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<th>Overturned</th>
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<td>Modular Innovation</td>
</tr>
<tr>
<td>Changed</td>
<td>Architectural Innovation</td>
<td>Radical Innovation</td>
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Linkages between Core Concepts and Components
Henderson & Clark’s framework for defining innovation

Based on Schumpeter, 1942

Core Concepts

Reinforced

Incremental Innovation

Overturned

Modular Innovation

Unchanged

Architectural Innovation

Changed

Radical Innovation

Don’t mirror
Mapping strategy
Strategy is not just having a plan –
– it’s understanding how you react in a complex environment
Your criteria for making decisions when you face uncertainty
“Everyone has a plan until they get punched in the mouth”

– Mike Tyson
Mapping 101
Why do we map?
Build collective context
Inform strategic technology decisions
Understand and visualise tradeoffs
“multiple overlapping and partially contradictory descriptions of the same act are always possible, and even necessary, to approximate the complexity of reality”

– Sidney Dekker
Subjective
Navigate complexity
Discover ambiguities
Discover uncertainties
Don’t replace architecture diagrams
Arch diagrams + maps: complimentary tools
What is a Wardley map?
It’s a tool that clarifies:

* Relationships
* Position in value chain
* Evolution/maturity
It’s a tool that clarifies:

* Hot spots
* Where new initiatives fit
Visibility to customers

Evolution/maturity
Start with user needs
Then add most visible systems
Solid lines represent dependencies
Add dependent systems
How to draw an owl

1. Draw some circles
2. Draw the rest of the fucking owl
Direction of travel
Visualise opportunities
Keep in mind:

* Subjective
* Visibility informs priority
* Maturity informs investment
* Don’t replace arch diagrams
* Maps change over time
As the complexity of a system increases, the accuracy of any single agent’s own model of that system decreases rapidly.

Woods' Theorem
Wardley maps

Topographical intelligence in business

CHAPTER ONE (START HERE)
Wardley Mapping for Busy People

learn.hiredthought.com/p/wardley-mapping
• What are complex system
• Simple, rugged, and dancing landscapes
• The interesting in-between
• Explore/exploit
STELLA
Report from the SNAFUcatchers Workshop on Coping With Complexity

Brooklyn NY, March 14-16, 2017

Winter storm STELLA
Managing risk
<table>
<thead>
<tr>
<th>Probability</th>
<th>Trivial</th>
<th>Minor</th>
<th>Moderate</th>
<th>Major</th>
<th>Extreme</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rare</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
<td>Medium</td>
<td>Medium</td>
</tr>
<tr>
<td>Unlikely</td>
<td>Low</td>
<td>Low</td>
<td>Medium</td>
<td>Medium</td>
<td>Medium</td>
</tr>
<tr>
<td>Moderate</td>
<td>Low</td>
<td>Medium</td>
<td>Medium</td>
<td>Medium</td>
<td>High</td>
</tr>
<tr>
<td>Likely</td>
<td>Medium</td>
<td>Medium</td>
<td>Medium</td>
<td>High</td>
<td>High</td>
</tr>
<tr>
<td>Very likely</td>
<td>Medium</td>
<td>Medium</td>
<td>High</td>
<td>High</td>
<td>High</td>
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</table>
## Risk Register

<table>
<thead>
<tr>
<th>Risk</th>
<th>Likelihood</th>
<th>Impact</th>
<th>Assessment</th>
</tr>
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<tbody>
<tr>
<td>A bad thing happens</td>
<td>Very Unlikely</td>
<td>Significant</td>
<td>Medium</td>
</tr>
<tr>
<td>Something else bad happens</td>
<td>Possible</td>
<td>Severe</td>
<td>Medium High</td>
</tr>
<tr>
<td>A terrifying thing happens</td>
<td>Very Likely</td>
<td>Significant</td>
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Likelihood

% chance the thing will happen in the next 12 months
Impact

$ cost of impact expressed as range*

*90% confidence interval
### Before

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<th>Risk</th>
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<th>Impact Range</th>
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<tr>
<td>Something else bad happens</td>
<td>40%</td>
<td>$4,000,000 - $8,000,000</td>
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90 percent confidence interval
Use maps to understand your risk landscape
1. Understand aggregate risk position
2. Compare to appetite
2. Compare to appetite

![Graph showing probability of exceeding loss for different appetite levels. The x-axis represents the loss exceeded, ranging from 10 to 100,000,000,000. The y-axis represents the probability of exceeding loss, ranging from 0% to 100%. Three lines are shown: red for current, black dashed for appetite, and gray for residual. The graph illustrates the decreasing probability of exceeding loss as the loss threshold increases.]
3. Invest in:
   - Reducing uncertainty
   - Mitigation
The biggest risk?
We only look for answers in our field
Our niche becomes obsolete
We used to laugh at the box huggers
But building your own PaaS in AWS?
The 2019 version of being a box hugger
COTS PaaS meets user needs of 95% of teams
Your niche is going to disappear.
"It is not necessary to change. Survival is not mandatory."

– Edward Deming
Move up the stack
Understand the business model
Learn skills to navigate uncertainty & ambiguity
Kill your heroes
Thank you! ❤

❤ the talk? Let @auxesis know.
Learn more:

- Algorithmic Impact Assessment report 2018
- Stella Report
- Wardley Mapping for busy people
- Wardley Maps book
- The Great Courses: Understanding complexity
Learn more:

- How to measure anything
- How to measure anything in cybersecurity
- Organisational culture and leadership (Schein)
Learn more:

- **Organization design: an information processing view** (Galbraith, 1974)

- **Architectural Innovation: The Reconfiguration of Existing Product Technologies and the Failure of Established Firms** (Henderson and Clarke, 1990)