

Toby Lorne Welch-Richards

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Toby is a highly-motivated and process-driven systems engineer who has experience architecting, developing, and operating complex systems. He has strong written communication skills, and works well both as an individual contributor and as a technical lead.

Toby is passionate about automation, networking, engineering reliability and resilience, safe and repeatable releases to production, and teaching people how to code. He is an advocate for open-source software and is looking to provide a meaningful and positive contribution to society.

Recent roles

- Booking.com - Senior Site Reliability Engineer (2021-)
- Foreign, Commonwealth, Development Office (2020-2021)
- Government Digital Service - Senior Site Reliability Engineer (2017-2020)
- Government Digital Service - WebOps Engineer (2017-2017)
- Macromasures - Co-founder (2014-2017)

Programming languages and technologies

- Proficiency with Go, Python, Ruby, JS, Bash, Terraform, Puppet
- Proficiency with Kubernetes, OpenStack, AWS, VMware, and BOSH
- Proficiency with Prometheus, Grafana, ELK, AWS CloudWatch, Graphite
- Familiarity with SML, F#, Rust, Crystal, GCP, Splunk
- Networking:
 - Multi-site (IPSec Prime/Foundation/CATAPANs, Strongswan, routing protocols, wireguard)
 - Software-defined (CNI, Istio, MetalLB, bird)

Recent projects

Booking.com Private Cloud

Booking.com is adopting public cloud, and containerising infrastructure. Some highly-optimised legacy workloads cannot be containerised for ergonomic reasons and cannot be run on public cloud for performance reasons. Multiple OpenStack clouds in geographically distributed, first-party data centers were the migration targets.

- Wrote integrations between first-party tools and OpenStack (provisioning projects)
- Architected and implemented service for exposing OpenStack inventory to users and downstream systems
- Capacity and timeline analysis/planning of migration of workloads (from proof-of-concept to serving live Booking.com traffic)

- Supported client teams (storage: MySQL, Kafka, Elasticsearch) doing proof-of-concept work to evaluate low latency storage options (SAN, local NVMe, etc)

GOV.UK Emergency Alerts

[GOV.UK Emergency Alerts](#) is the UK emergency alerting infrastructure which sends emergency alerts to mobile phones using cell infrastructure via the four UK mobile telecommunication providers

- Architected and built initial connectivity integration with mobile telecommunication providers
 - (O2, British Telecom, Vodafone, Three)
- Collaborated with [UK NCSC](#) to evaluate set cryptographic standards for telecom partners
 - Secure connectivity between cell infrastructure management components
 - Site-to-site connectivity using IPsec VPNs
 - Digital signing and verification using CAP with XMLDSig
- Implementation using Python, Concourse, Cloud Foundry, AWS Lambda and networking services

GOV.UK Platform-as-a-Service

[GOV.UK PaaS](#) is a hosting provider for the UK public sector which supports hundreds of developers from over a hundred teams across the UK public sector

- Core platform operations using BOSH, Cloud Foundry, Concourse, Terraform, Go, Ruby, Bash, Docker, Prometheus + Grafana
- In/out-of-hours support and incident remediation
- Reducing expenditure of core platform through the implementation of reserved instances and spot instances
- Significantly expanded test coverage using RSpec (Ruby) and Ginkgo/Gomega (Go)
- Release engineering to speed up pipelines and run availability tests during deployments to improve reliability
- Implemented billing and reporting features to track currency changes and to aid the generation of purchase orders
- Component lead on implementing single-sign on to increase security of the platform
- Component lead on reimplementing and migrating the database engine of the GOV.UK Performance Platform from MongoDB to Postgres. This was part of the work to decommission IBM Compose.io as a GOV.UK PaaS supplier
- Open-source collaboration with upstream Cloud Foundry Foundation teams
- International open-source collaboration with [18F](#) (GDS USA counterpart)

[GDS](#) CI/CD tooling

Architected and implemented multi-tenant deployment of [Concourse](#). Users are across >12 teams across multiple government organisations and manage >100 deployment pipelines.

Concourse is a distributed system which [GDS](#) deploy to AWS via Terraform, the control plane is shared but each team uses isolated pools of compute resources and has separate network egress.

A self-hosted solution was necessary because of security and information assurance concerns.

Across [GDS](#)

- Management of central AWS organisation: account management, and access to billing data
- Management of central SaaS procurements: PagerDuty, Cronitor, Pingdom

- Organisation of "Infrastructure weekly" meeting for cross-GDS incident communications
- Technical engagements and evangelism with other government departments (NCSC, Home Office)
- Development and evangelism of shared GDS tooling: e.g. GDS CLI, Rotas app

GDS CLI tooling

Implemented an internal, cross-platform, Go CLI tool for use by developers and engineers at [GDS](#). It:

- automates the configuration for AWS access with AWS Vault
- is a self-documenting, interactive interface for each team to automate individual tasks
- assists GPG signing merge commits with GitHub to support cryptographically verified continuous deployment
- has an automated release pipeline managed by Concourse

GOV.UK Verify replatforming

[GOV.UK Verify](#) is an online identity verification platform for UK residents. Technical lead - responsible for planning and delivery against a large backlog of organisation wide technical debt

- Challenged assigned objectives to deliver more value for reduced cost (>\$150k USD annual savings) through the redesign and implementation of GOV.UK Verify's cloud architecture. Implemented a new infrastructure that is continuously deploying using Concourse, Terraform, Amazon Elastic Container Service (ECS), and Prometheus + Grafana
- Retooled GOV.UK Verify's existing monitoring, alerting and deployment infrastructure with an internal ECS Platform running Grafana, in-house dashboarding, and Concourse.
- Managed and rolled out best practice for centrally procured alerting SaaS: - PagerDuty and Cronitor
- Threat modelling, penetration testing, and security architecture
- Training developers in how to support and observe their apps, and how to operate the new continuous deployment pipelines

GOV.UK Pay replatforming

[GOV.UK Pay](#) is an online payments platform for UK residents.

- Onboarded onto the team to implement Amazon ECS and migrated existing application deployment from Ansible
- Re-engineering deployment automation to ensure that deployment was more visible and safer (Jenkins, Ruby scripts, and custom Ruby-on-Rails deployment visualisation tool)
- Created CLI tooling to help developers develop/operate/support the platform
- Created back-office web application to assist with onboarding of new services
- Reimplemented performance reporting: the previous reporting system relied on parsing logs, as a result financial information was incorrectly reported. Added new endpoints on internal microservices to support public reporting functionality
- Implemented frontend A/B testing resulting in reduction of payment completion drop-off by 25%

Automation of support rotas at [GDS](#)

The [rotas app](#) is a Ruby-on-Rails web application which replaced the plethora of spreadsheets used to manage on-call and support rotas. It is used by over 10 teams and:

- integrates with PagerDuty and calendars (eg Google, Apple, Outlook)
- implements an audit trail to track usage of contact details
- tracks annual leave to find conflicts between support rotas and annual leave

Macromeasures

Toby co-founded Macromeasures in 2011. Macromeasures was a data company based in Montreal and New York, now owned by StatSocial

Technical work

- Built initial infrastructure on-premise infrastructure at McGill university
- Migrated infrastructure to IBM SoftLayer, and then to AWS
- Re-architected from raw EC2 architecture to ECS - to achieve a 30% reduction in infrastructure costs
- Design, implementation, operation of large database clusters: Riak, Postgres, MongoDB, Redis
- Large scale database migrations to reduce cost savings
- Management of > \$100,000 (USD) annual infrastructure budget and spending
- Built internal CLI, web applications, data pipelines
- Developed and operated customer and partner facing web apps
- Created customer facing software integrations and tools - Google Sheets, Hootsuite, Twitter API, Instagram API

Non-technical work

- Introduced and managed reproducible sales pipeline using Salesforce CRM and Persist-IQ
- Built semi-automated system for lead-sourcing using proprietary and third-party data sources and tools
- Created sales decks, marketing materials, and contracts
- Grew annual recurring revenue from \$0 to \$150k USD in 12 months
- Sold software and services to both startups and large companies (Fortune 1000)
- Managed technical and non-technical relations with revenue-share data partners

Line management, and recruitment at [GDS](#)

- Line managed site reliability engineers, developed curriculum to improve coding ability of line reports
- Designed and ran an interactive training/gameday for 60 technical staff using AWS, Concourse, Splunk, and post-it notes
- CV sifting, phone interviews, chairing in-person interviews (civil servants and contractors)
- Wrote SRE interview code-comprehension question to ensure all SREs were screened for coding proficiency
- Participated as a coach in internal programme within GDS to teach programming to non-technical staff
- Frequently attended [codebar](#) as a coach - codebar is a charity that seeks to make tech more diverse by running programming workshops

Open Source Software

Contributor to [Cloud Foundry](#) - an open source, multi-cloud application platform

Contributor to [Concourse](#) - a distributed system for continuously doing things

Contributor to [GCHQ CyberChef](#) - an intuitive web app for data analysis, encryption, and other "cyber" operations

Maintainer of [petitions exporter](#) - a Prometheus exporter for the UK government petitions website

Maintainer of [some gallery thing](#) - a serverless web app for finding art exhibitions in London and Amsterdam

Misc. contributions to CNCF projects: CNI, Istio

Recent public speaking

- Cloud Foundry Europe Summit 2020 - [How Cloud Foundry Goes Bang](#)
- FOSDEM 2020 - [From a Pipeline to a Government Cloud](#)
- Concourse London User Group - [Operating a multi-tenant Concourse](#)

Education

- Software Engineering B.Sc. from McGill University (Montreal, QC, Canada)
- Undergraduate exchange at MIT (Cambridge, MA, USA)