Application Security Automation and Optimization

Janek Claus

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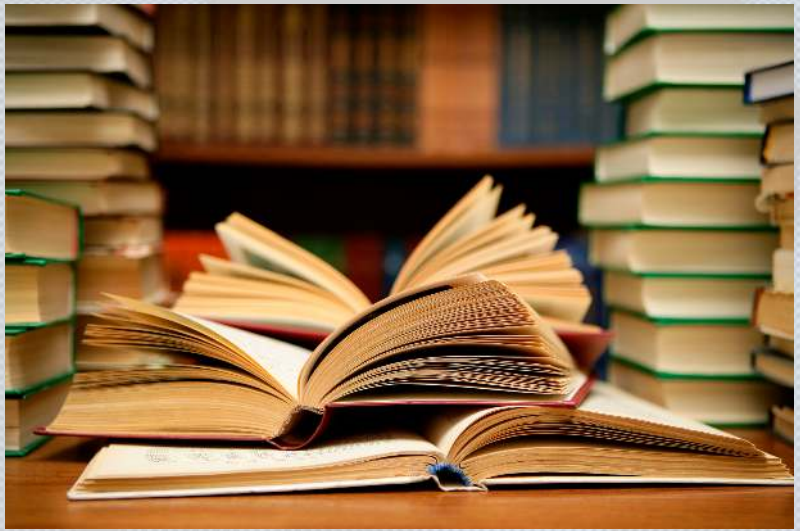
About the speakers

- Janek Claus
- DevOps Capability Lead in the Growth organization of General Dynamics Information Technology
- Various roles along the software production/delivery pipeline during 25+ year career
- Previous domains include automobile, logistics, retail, telecommunications, software startup, agriculture and public sector
- Know the pain points

- Svetlana Yazhuk
- DevOps engineer for a large civilian customer
- Supports a platform for continuous deployment of containerized applications
- 10 years in IT with experience for enterprise applications and servers
- Started DevOps about 4 years ago
- Interested in cloud infrastructure, deployment automation and orchestration and container technologies

Topics

- Application security challenges
  - Talent shortages
  - Functional silos
  - Hesitation to change
  - Authority to operate
  - Secure DevOps tools integration
  - Secure software supply chain
- DevOps-as-a-Service platform
- Solution platform deep-dive



Source: Image by Abhi Sharma
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Challenge #1: Talent shortages

- Not enough security specialists to embed into each team (see e.g. GAO-17-533T)
- 74% of agencies are “At Risk” or higher
- Attrition: people want to work in a modern work environment
- Security training interrupts work day/week

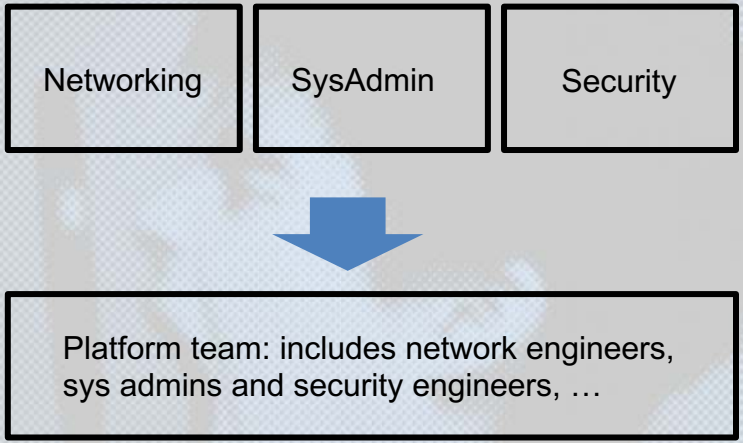
Source: https://www.limeade.com/2015/01/top-6-posts-2014

Possible solutions:

- Bake automated security into the pipeline (for application security)
- Rely more on developers and testers, but give them the tools to be successful
- Use continuous security
- Gamify training, use code bashing techniques

Challenge #2: Functional silos

- Multiple separate teams and hand-offs
- Teams for:
  - Network engineers
  - Storage engineers
  - System administrators
  - Security specialists
  - …



Possible solutions:

- Conway's Law: create an organization that resembles your goals
- Create a platform team offering DevOps-as-a-Service

Challenge #3: Hesitation to change

- Architectural changes may be needed
- New tools may be introduced
- New processes may need to be implemented
- “Culture Eats Strategy For Breakfast” Peter Ducker

Possible solutions:

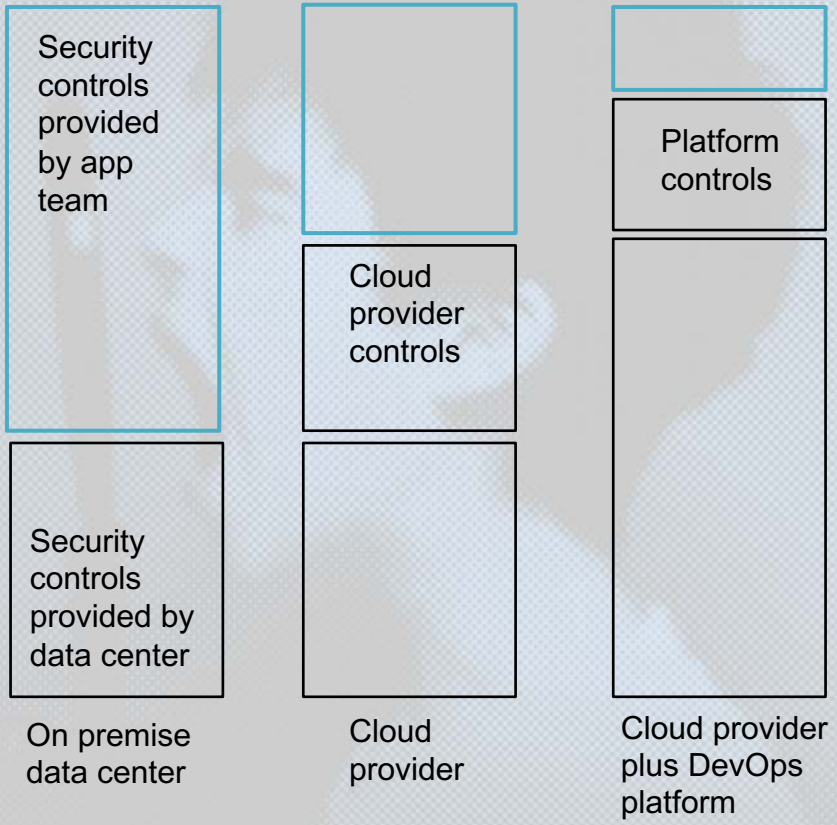
- Continued training and coaching sessions, but trying to minimize interruptions
- Education/lecture series on tools, concepts, concrete implementation steps
- Sustained executive management support and long-term vision

Challenge #4: Authority-To-Operate

- Assembling/documenting controls in the System Security Plan (SSP) is time consuming (see NIST SP 800-53)
- Sometimes takes months

Possible solutions:

- Leverage cloud solutions
- Develop DevOps-as-a-Service platform and obtain an ATO for the platform



Challenge #5: Secure DevOps tools integration

- DevOps tool chain itself also needs to be secured
- Often dozens of tools
- Introducing DevOps without security governance creates a heightened risk
- Each DevOps tool has their own privileges/credentials
- Secrets management not centralized

Possible solutions:

- Prefer solutions that offer integrated credentials management across the DevOps pipeline
- Employ a secrets management solution

Source: https://blog.devolutions.net/2018/03/why-your-business-needs-a-secure-digital-vault

Challenge #6: Secure the software supply chain

- 80-90% of software is composed of third-party libraries
- Many contain known vulnerabilities, yet are included anyway
- Many open-source libraries don’t have CVE’s filed due to burden for the developer

Possible solutions:

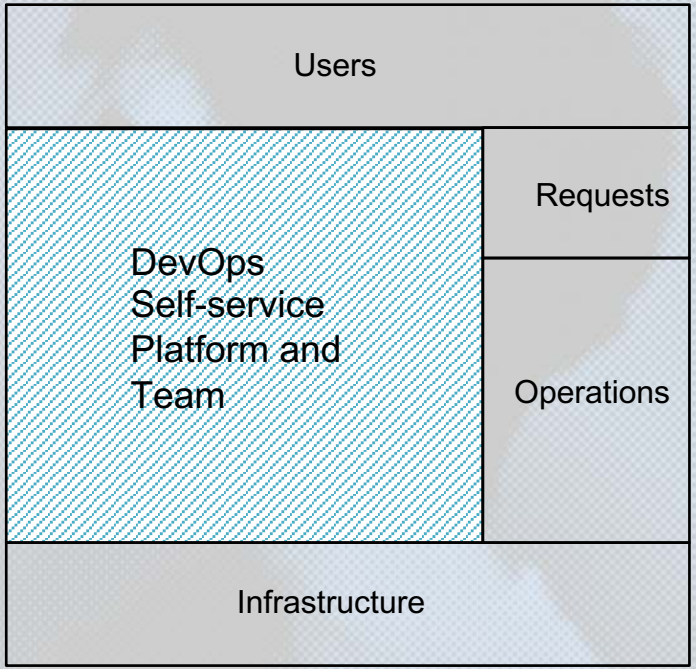
- Employ tools that scan libraries before they enter the value stream
- Employ Runtime-Application Self-Protection tools
- Leverage existing open-source intelligence when possible
- Use tools able to continuously monitor applications during development, testing, deployment and runtime

DevOps-as-a-Service team and platform

- Culmination of efforts to address above challenges
- Platform team combining all necessary skills
- Focused on building out the platform
- Created Monarch platform

Key goals and concepts

- Embedded security into CI/CD workflow
- Immutable infrastructure
- Infrastructure as code
- Self service for development teams
- Achieve platform ATO
- Ensure security compliance of deployed applications
- Consistency between environments
- Applications not tied to infrastructure



Continuously increase self service capabilities

Monarch overview

Development Teams

- Manage
- Examine
- Troubleshoot
- Monitor

go Continuous Delivery

- Source
- Build
- Store
- Deploy
- Run
- Scan

GitHub Enterprise

docker

JFrog Artifactory

Terraform

Amazon ECS

Twistlock

netsparker

Self-service security scanning

GOALS
Ensure application security compliance
Deliver more secure applications, more frequently

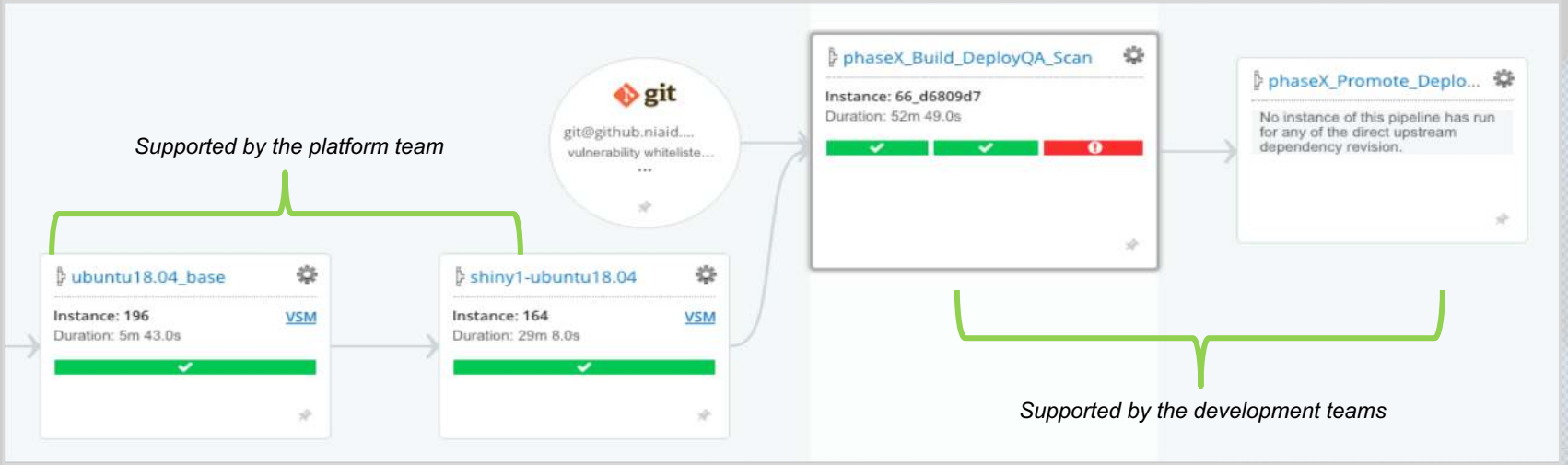
PROBLEM
Multiple hand-offs and manual gatekeeping

SOLUTION
Embed security scanning into deployment pipelines

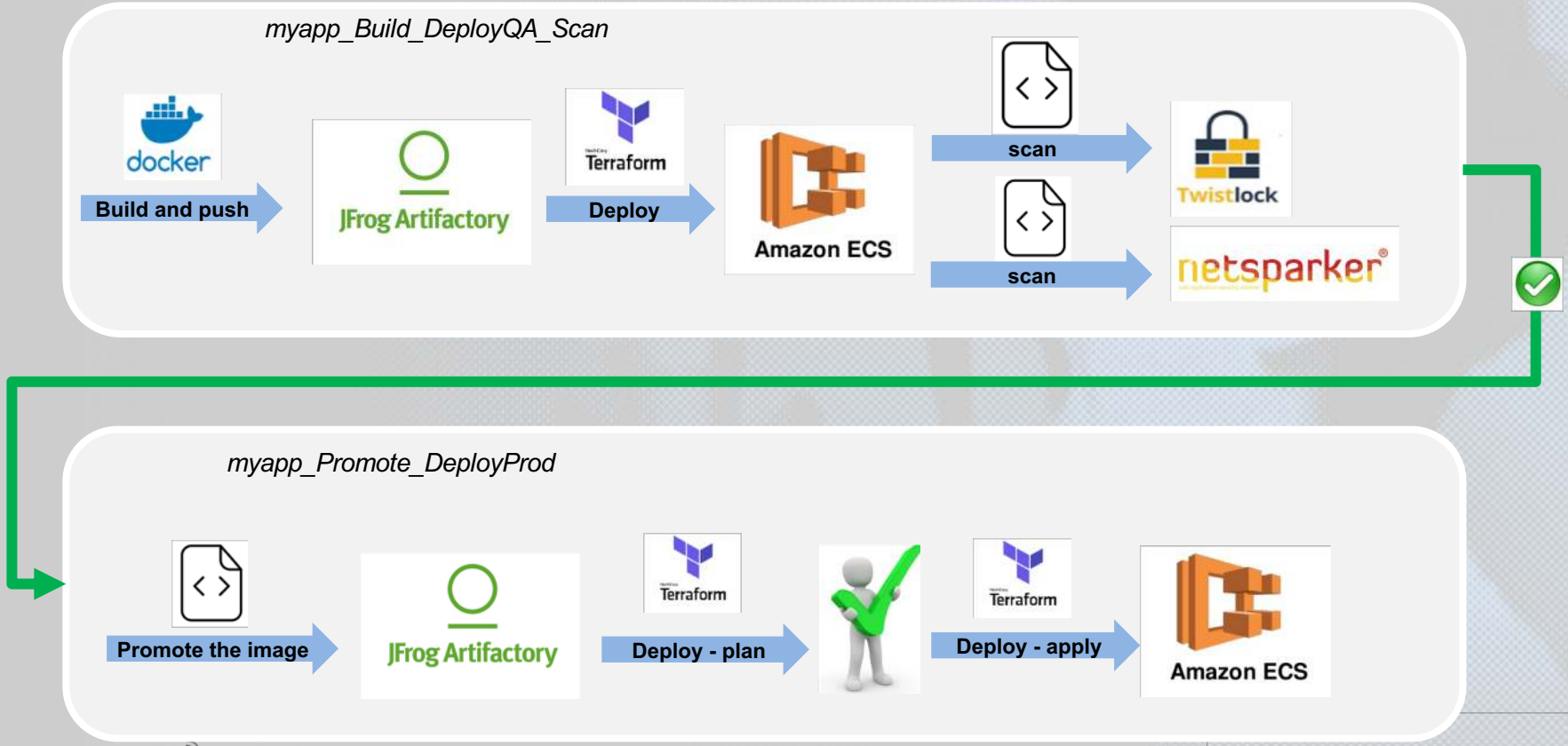
ELEMENTS
Container image scanning
Dynamic application scanning

Implementing deployment pipelines in GoCD

- Pipelines triggers - SCM repositories or another pipeline(s)
- Complex workflows via pipeline dependencies
- Streamlined pipeline creation via templates



Security scanning in pipelines



Twistlock – Docker image scanning

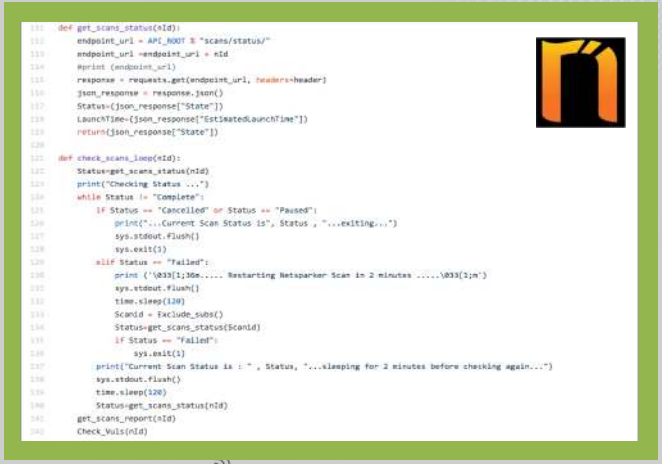
- Check software binaries, libraries, etc. for known vulnerabilities (CVEs)
- Scan application images files & packages
- Analyze Dockerfile and image metadata to detect insecure configurations:
  - running as privileged user
  - sensitive information in environment variables

```
[go] Task: twistlock_scan.rb took: 17.389s

Pulling down monarch-p                                    s:274_439ff72... got it!

Checking to see if twistlock.internal.                    is up... it is!

Grab the login token... acquired!

Starting a scan... started!

Getting your scan results in 10 seconds... got them!

Creating raw_scan_report.json and short_scan_report.json artifacts... complete!

No vulnerabilities or compliance violations detected!

Pruning old images and containers... complete!
```

```ruby
twistlock_host = ENV["TWISTLOCK_HOST"]
registry_host  = ENV["REGISTRY_HOST"]
user           = ENV["TWISTLOCK_USER"]
pass           = ENV["TWISTLOCK_PASS"]
repo           = ENV["IMAGE_REPO"]
name           = ENV["IMAGE_NAME"]
tag            = ENV["IMAGE_TAG"]
url            = "http://#{twistlock_host}:8081/api/v1"

if ( repo == "" )
  scan_repo = "#{registry_host}/#{name}"
else
  scan_repo = "#{registry_host}/#{repo}/#{name}"
end

request_body_map = {
  :host => "#{twistlock_host}",
  :imageTag => {
    :repo => "#{scan_repo}",
    :tag  => "#{tag}"
  }
}

begin
  RestClient.post("#{url}/health/images/scan",
                  request_body_map.to_json,
                  {:authorization => "Basic #{Base64.strict_encode64("#{user}:#{pass}")}",
                   :content_type  => 'application/json',
                   :accept        => 'application/json'})
```

Netsparker Cloud – web app scanning

- Detect and exploit different vulnerability types:
  - -cross-site scripting (XSS)
  - SQL injection
  - local/remote file inclusion
  - command injection
  - server-side request forgery (SSRF)
- Detect old web applications and libraries



```
def get_scans_status(nId):
    endpoint_url = API_ROOT % "scans/status/"
    endpoint_url =endpoint_url + nId
    #print (endpoint_url)
    response = requests.get(endpoint_url, headers=header)
    json_response = response.json()
    Status=(json_response["State"])
    LaunchTime=(json_response["EstimatedLaunchTime"])
    return(json_response["State"])

def check_scans_loop(nId):
    Status=get_scans_status(nId)
    print("Checking Status ...")
    while Status != "Complete":
        if Status == "Cancelled" or Status == "Paused":
            print("...Current Scan Status is", Status , "...exiting...")
            sys.stdout.flush()
            sys.exit(1)
        elif Status == "Failed":
            print ('\033[1;36m..... Restarting Netsparker Scan in 2 minutes .....\033[1;m')
            sys.stdout.flush()
            time.sleep(120)
            ScanId = Exclude_subs()
            Status=get_scans_status(ScanId)
            if Status == "Failed":
                sys.exit(1)
        print("Current Scan Status is : " , Status, "...sleeping for 2 minutes before checking again...")
        sys.stdout.flush()
        time.sleep(120)
        Status=get_scans_status(nId)
    get_scans_report(nId)
    Check_Vuls(nId)
```

```
[go] Task: Netsparker-Scan took: 13m 2.471s
my yaml_file is  monarch.yaml


Default Scan policy : Platform.2018.05

New Scan ID is  8dc6a70b-50d4-49fb-1def-a9750320125d
Scan requested for  https://m[redacted]/
..... Starting Netsparker Scan .....
Checking Status ...
Current Scan Status is :  Queued ...sleeping for 2 minutes before checking again...
Current Scan Status is :  Scanning ...sleeping for 2 minutes before checking again...
Current Scan Status is :  Scanning ...sleeping for 2 minutes before checking again...
Current Scan Status is :  Scanning ...sleeping for 2 minutes before checking again...
Current Scan Status is :  Scanning ...sleeping for 2 minutes before checking again...
Current Scan Status is :  Archiving ...sleeping for 2 minutes before checking again...


**************  Calculating Vulnerabilities  ********************

Original Count of vulnerabilities =  0

************ This website has no whitelisted items ***************


***** Recalculating ....(Any Whitelisted Items will be deducted) *****

New Total Vulnerabilities  =  0
```

Scanning configuration

monarch.yaml:

- Stored in the root of an application repo
- Contains application configuration for pipelines stages
- May include white-list items for web application and Docker image scans

```
name: myapp

docker_build:
  variables:
    IMAGE_REPO: myrepo
    REGISTRY_USER: mylogin

webapp_scan:
  variables:
    NS_URL: 'https://myapp.qa.domain.net/'
  whitelist:
    - Missing Content-Type Header:
    - "https://myapp.qa.domain.net/__sockjs__/n=AETttrbrbCun47684/054"

docker_scan:
  cve_whitelist:
    - CVE-2018-1234  # False positive
    - CVE-2018-5678  # Not applicable
```

Results and impact

CURRENT STATE

- Early vulnerability detection
- Quick remediation response (mitigating Spectre and Meltdown for all apps took less than 5 days)
- Frequent updates in production are encouraged
- Multiple parties involved in security auditing

IN THE WORKS

- Code quality monitoring

sonarqube

Conclusion

- Facing large challenges in securing software production and delivery
- We outlined six of them and how our team together with our customer addressed them
- It’s a continuous improvement process and never ends
- Application security governance program for coordination highly recommended

Source: https://commons.wikimedia.org/wiki/File:The_road_ahead_(2046262670).jpg

- Thank you for joining us!

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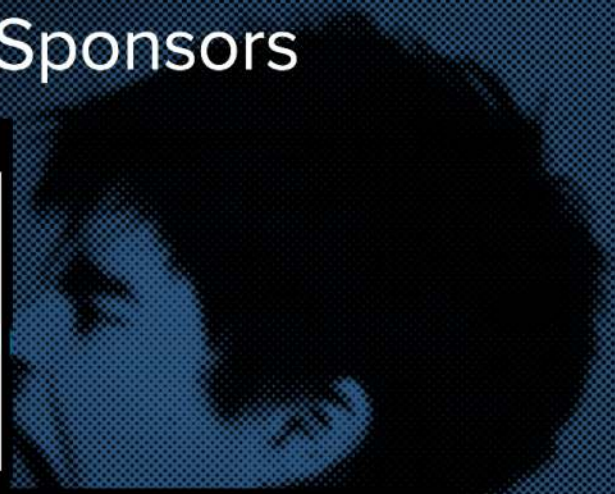

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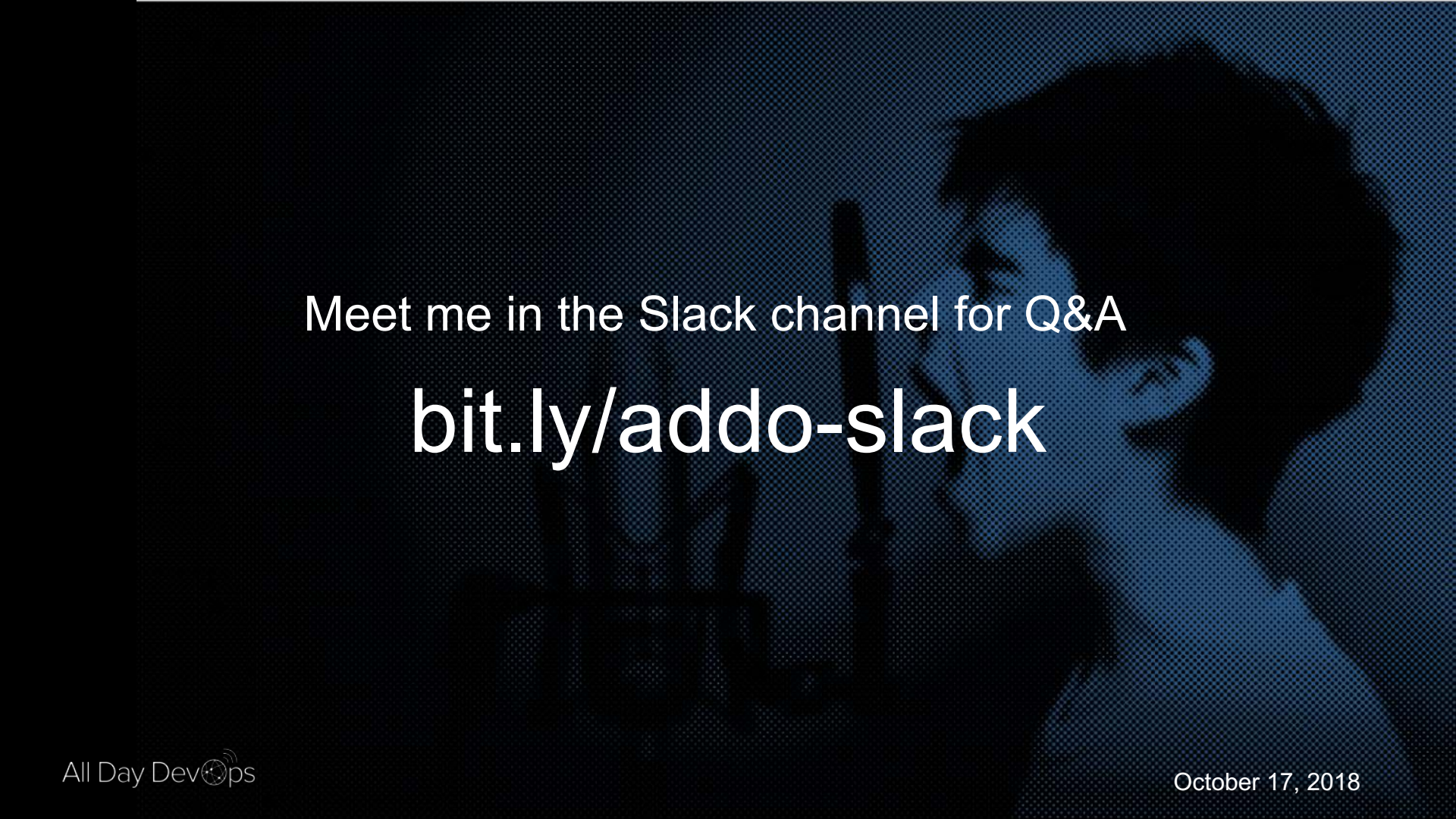
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bit.ly/addo-slack
All Day DevOps
October 17, 2018