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ACCELERATING CAF DIGITIZATION: IMPLEMENTING DevOps

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ACCELERATING CAF DIGITIZATION: IMPLEMENTING DevOps

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Even well-meaning gatekeepers slow innovation.

— Jeff Bezos, *Letter to Amazon Shareholders*

AIM

1. This paper aims to provide the Chief Development Officer (CFD) with an analysis of the adoption of a digital acquisition Development-Operations (DevOps) model, demonstrating the advantages that it could bring to the CAF. This service paper also examines why DND needs to evolve their digital acquisition strategy and how a DevOps and cloud-based architecture can lay the foundation to achieve it. It will also discuss the feasibility of adopting the model within DND and conclude with suggested areas of further analysis.

INTRODUCTION

2. DND's current acquisition model is primarily analogue based, which is no longer adequate warfighting capabilities at the pace needed for current and future operations. Canada depends on a military that can keep pace with our allies on the technological front and more critically capable of countering emerging threats posed by peers and near-peer and cyber adversaries. DND's future capability development portfolio will demand an advanced digital ecosystem suited to support current and emergent technologies.

3. The pace of technological advancement has pushed allied forces and peer adversaries to become increasingly digitized. It is now necessary to operate seamlessly in all domains of war[1]. The world is seeing an increasing proliferation of Artificial Intelligence, Machine Learning, and Edge Computing that is revolutionizing how the commercial sector is

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[1] William Richardson et al., *Toward Agile Procurement for National Defence: Matching the Pace of Technological Change*, 2020). 4.

accelerating and democratizing technology[2]. Therefore, the CAF must accelerate our digital acquisition strategy and evolve the digital architecture from which it is based; effectively transforming DND from an analogue to a digital-based development and acquisition model. Canada's Defence Policy, *Strong, Secure, Engaged*, identifies the need for a more innovative and flexible acquisition program that traditional barriers will not encumber[3]. Moreover, the VCDS recently identified four priorities for the Capability Development community for Data and Digitization, requiring a transformation from idea to capability[4]. This paper will look at how DND could innovate the digital acquisition model by looking at the tenets of a DevOps framework and an open-access cloud-based architecture. It will then demonstrate its application within DND, outlining where key benefits and challenges could be achieved.

DISCUSSION

4. The traditional waterfall model of project acquisition DND employs does not work for software and high-tech digital capability development. This model is a fundamentally analogue in nature and is too slow and rigid compared to the pace of technological change the world is now seeing. The new digital landscape demands organizations to adapt and evolve to survive. Dr. Will Roper, former assistant secretary to the United States Air Force acquisition program, likened this problem to evolution theory. Those organizations able to adapt and maneuver in this new digital ecosystem will prevail; those who cannot adapt will succumb to the same fate as the dinosaurs. "With so many commercial technologies on the brink of a breakthrough, our military ecosystem will be disrupted. Meteors are coming, requiring new forms of 'flight' to survive"[5].

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[2] B. Russ, M. Mike and H. Steve, *GCHQ: Boiling Frogs?* UK MoD, 2016). 6.
[3] Canada, *Strong Secure Engaged Canada's Defence Policy* (Ottawa: Department of National Defence, 2017). 16.
[4] LGen M. Rouleau, *VCDS DMA Planning Guidance Data and Digitization*, 2020). 2.
[5] Will Dr Roper, *Passing the Baton in a Competitive Ecosystem and a Final Farewell*Department of the Air Force, 2021).

5. There has been a downward trajectory since the Cold War, with the defence industry no longer possessing technical dominance; arising from a failure to change business and policy at the same speed as technological innovation[6]. Adversaries realize this by exploiting vulnerabilities in the new digital landscape through cyber and hybrid warfare[7]. DND will need to evolve and accelerate how we can deliver warfighting tools at the advanced threat landscape's pace. The DevOps capability development framework is an evolutionary step employed by the USAF to counter emergent threats and maintain its lethality. It is a framework that the CAF should also adopt to accelerate our digital acquisition process needed for future warfare.

5. The problem space that is hindering the CAF's ability to evolve in the digital ecosystems is based on its process to bring capabilities to bear. The DND acquisition process is tied to a rigid and influenced policy by other government departments such as the Treasury Board Secretariat (TBS) and Public Services and Procurement Canada (PSPC). Former Assistant Deputy Minister (Materiel) Alan Williams indicated in 2006 that DND procurement strategy hindered operational capabilities due to strong dependencies on TBS and PSPC[8]. This process bogs down our procurement process, which is mandated in DND's Project Approval Directive (PAD), which is the roadmap for capital acquisitions[9]. Despite being renewed in 2019, it still does not account for digital acquisition or fast-paced technology acquisition. Unfortunately, DND's procurement history proves that it treats the PAD as a one

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[6] Ben Fitzgerald and Kelley Sayler, *Creative Disruption: Technology, Strategy, and the Future of the Global Defense Industry*Center for a New American Security,[2014]). 8

[7] *ibid* 11

[8] Alan S. Williams, Breakout Educational Network and Queen's University (Kingston, Ont.). School of Policy Studies, *Reinventing Canadian Defence Procurement: A View from the Inside* (Montreal: Published for Breakout Educational Network in association with School of Policy Studies, Queen's University and McGill-Queen's University Press, 2006).

[9] Canada, *Project Approval Directive (PAD)*Department of National Defence, 2019).

size fits all solution. Building in capacity for agile digital acquisitions using a DevOps model would enable quicker capability development that our warfighters need.

6. The software and high-tech industry have already transformed how they innovate and execute digital acquisition faster than any other industry. They needed it to deliver products ahead of their competition. The defence industry needs to provide capability ahead of the adversary, so leveraging industries' best practices is logical. This is precisely the approach the USAF and DoD took, and it is showing promising results.

7. The case for change was realized within the USAF when in 2017 when looking to create a new digitized system for Air to Air Refueling (AAR) within 609th Air Operations Center (AOC). After ten years and $750M spent with no effective software delivered, the DoD was motivated to change their process. They created a Defence and Innovation Unit Experimentation (DIUx) to address how the USAF conducts digital procurement. Under the DIUx organization, they leveraged the knowledge and tools of industry and integrated them within the DoD organization to develop an agile solution for the AAR problem. The result was a team that consisted of six USAF personnel, teamed with industry experts from Pivotal Labs who delivered a mission-ready solution in 4 months for only $2M[10]. This team the USAF assembled proved the merits of a DevOps environment.

8. DevOps represents an innovative approach to how the software industry changed how they did business to keep up with consumer demand and technology's accelerating pace. It has been the center of a software development movement over the past decade. Organizations are seeing benefits of the model for other commodities and overall agility within the business. Historically the software engineers, designers, and developers (The 'Dev') worked in isolation

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[10] Mark Wallace, "The U.S. Air Force Learned to Code - and Saved the Pentagon Millions," https://www.fastcompany.com/40588729/the-air-force-learned-to-code-and-saved-the-pentagon-millions (accessed 1 Feb, 2021).

against a set of fixed requirements. The I.T. department and operations staff (The 'Ops') worked separately to keep their systems operational. When the ‘Dev’ team was ready with a new product, a discrete downtime needed to be scheduled, disrupting operations and imposing risk[11]. DevOps fuses the two groups, sharing understanding and requirements and working in unison to deliver more reliable, timely and higher quality products. Another advantage is that it allows products to deliver products more iteratively following the ‘fail fast’ culture ultimately buying down overall risk[12]. DND is still mainly working with the Dev and Ops team separately; this needs to change.

9. Since 2011 industry leaders in agile development have assessed a DevOps acquisition model's benefits across 2400 IT and software professionals worldwide. Where traditional software development models operate with designers and developers creating the software, the annual report categorizes companies on the spectrum on how evolved their DevOps model is and the benefits realized at each level, as indicated in Figure 1. For reference, according to the report’s metrics, DND would not even make it on this scale.

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[11] Kieran Taylor, Aruna Ravichandran and Peter Waterhouse, *DevOps for Digital Leaders: Reignite Business with a Modern DevOps-Enabled Software Factory* (Berkeley, CA: Apress, 2016). 6.
[12] *Ibid.* 95

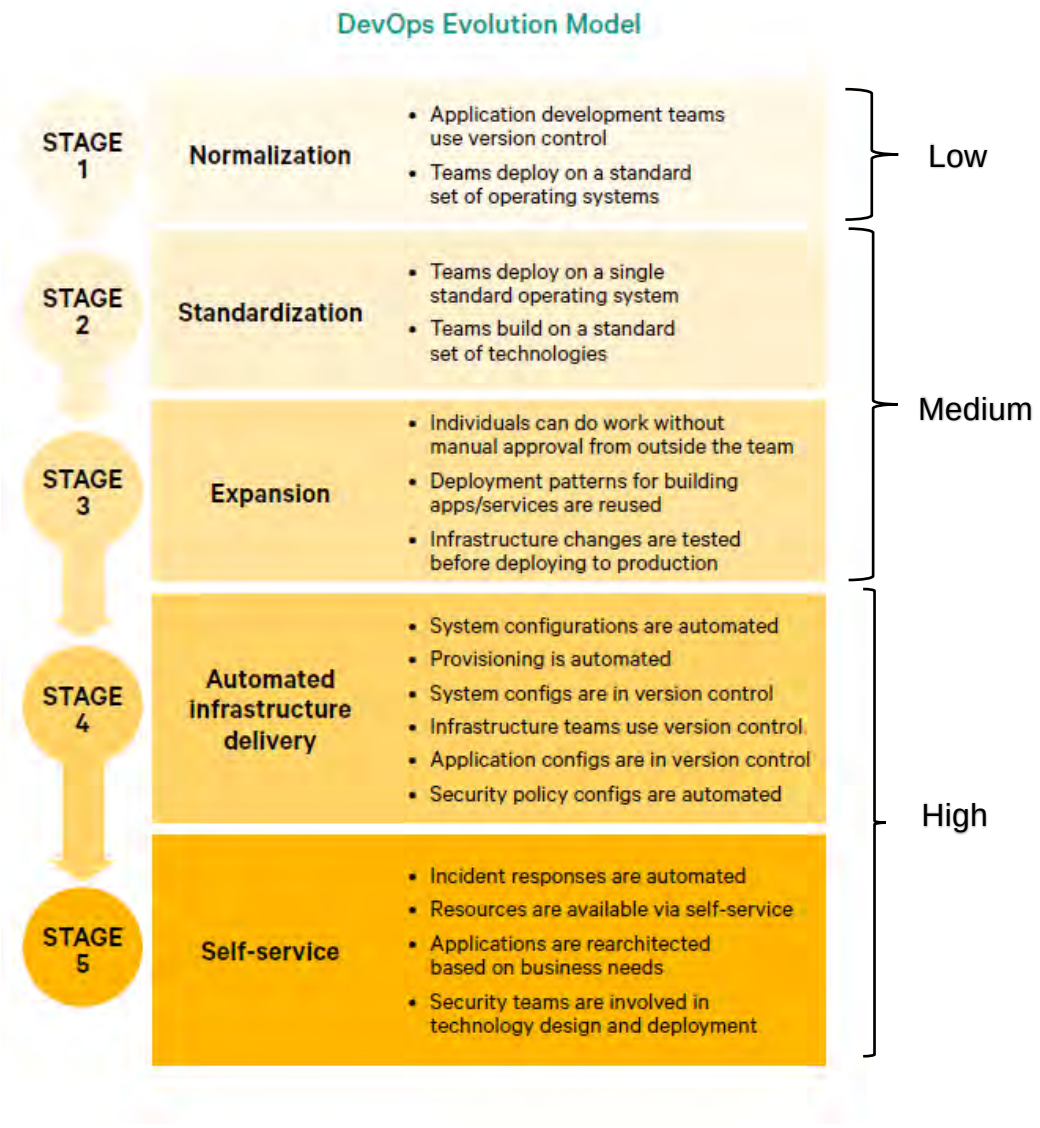

Figure 1 – DevOps Evolution Model

Source: *Puppet Release State of DevOps 2019, 10.*

10. The 2020 report ranked companies as low, medium, or high on the DevOps evolutionary spectrum. Companies that were ranked medium to high showed an exponential increase in efficiency, quality, security and had increased morale among their staff. In the commercial sector, companies that are high on the spectrum ranked within the Fortune 100 and realize a DevOps framework is an evolutionary imperative to succeed in the business

world[13]. In a paper on transforming DoD acquisition, Dr. Roper states: "The digital world is now a primal acquisition battlefield where future wars will be won or lost"[14]. Given the digital evolution of warfare, a DevOps framework will also be a mandatory evolutionary step for winning wars.

11. The advantages of agility that the DevOps model provides is now recognized by PSPC. To generate greater awareness throughout all departments on the benefits it can provide organizations, they have developed a 1st addition procurement playbook[15]. PSPC also recognizes the waterfall procurement model's limitations and outlines a roadmap for when departments need to pivot to an agile acquisition model. They compare the two models in Figure 2 below.

Traditional "Waterfall"		Agile Procurement
Procurement planning at beginning of procurement process only	→	Procurement planning at beginning of and throughout procurement process
Little or no engagement with stakeholders.	→	Ongoing engagements with stakeholders throughout procurement process
Adversarial relationship with industry.	→	Collaborative relationship with industry
Low user buy-in.	→	High user buy-in
Detailed technical requirements (high specificity, low flexibility)	→	Outcome-based specifications (less specific, more flexibility)
Evaluation of lengthy, written proposals	→	Evaluation of more concise written proposals plus presentations, prototypes, samples, demonstrations, videos, etc.
Evaluated on ability to write	→	Evaluated on strength and demonstration of innovation and approaches
Long contract periods	→	Shorter contract periods with Go/No Go decision points
No negotiation before contract award	→	Potential to negotiate before contract award (Consult legal services)
Course corrections, if possible are costly, in time and money	→	Continuous corrections are expected and save time and money
Most failures take place after considerable investment	→	Any failures take place earlier and are less expensive
Distributed Effort	→	Resource Intensive (Many FTEs involved/dedicated to project)

Figure 2 – Waterfall vs Agile Procurement Comparison

Source: *Vinet, Hassan, PSPC Town Hall Presentation, 2020, (with permission)*, 8

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[13] "Puppet Releases 2019 State of DevOps: Industry Report Card." *Entertainment Close-Up* (2020). 51.
[14] Will Dr Roper, "There is no Spoon: _The New Digital Acquisition Reality," (October 7, 2020). 3.
[15] Public Services and Procurement Canada, *PSPC Acquisitions Program Agile Procurement Playbook*, 2020). 5.

12. Although DND is not an I.T. or software development company, it is important to recognize digitization and the technologies driving it will be at the core of future warfare. This section will identify the first steps DND will need to take to achieve the benefits realized through a highly functioning DevOps organization.

13. Building the foundation is a critical first step in any transformation. There needs to be a common digital acquisition platform and agile development framework to take ideas from inception to delivery. In the case of DevOps, it will be transforming how DND manages their I.T. resources and software. According to the DevOps Research Organization (DORA) there are vital steps to evolve their DevOps framework[16]. The USAF indicated as key in their DevOps transformation as chief among them is the ability to deliver continuously, but this needs to be bolstered by changes in culture and I.T. enterprise architecture.

14. New enterprise architecture must be one that can be fully integrated across all components and services, which will translate a requirement for one to potential capability for all. DND's current enterprise architecture is currently siloed from an organizational and I.T. systems perspective, which leads to stove-piped development and insular capabilities. The development of a Cloud Platform, where DND would outsource most of the I.T. Services and focus on capability development, would establish a foundation conducive to a high performing DevOps organization. Currently, the DND's digital and I.T. acquisition model aims to ensure responsibilities in every component of our digital ecosystem, from the networking infrastructure to the applications used by warfighters, each element of our 'technology stack'[17]. Figure 3 illustrates where DND evolution needs to occure to implement DevOps at the enterprise level.

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[16] DORA, "Latest Accelerate State of DevOps Report," *Database and Network Journal* 49, no. 4 (Aug 01, 2019). 39.

[17] Taylor, Ravichandran and Waterhouse, *DevOps for Digital Leaders: Reignite Business with a Modern DevOps-Enabled Software Factory* (Berkeley, CA: Apress, 2016). 24.

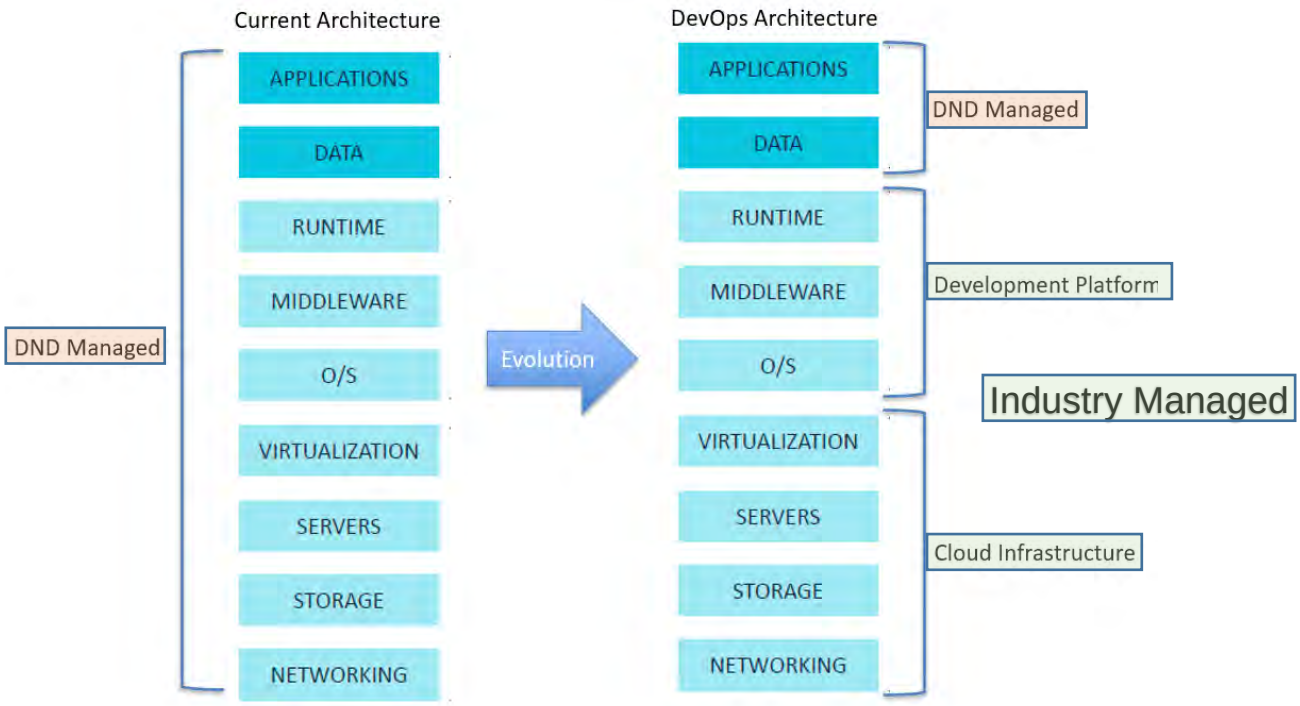

Figure 3 – Transforming DNDs tech stack.

15. The tech stack illustrates the concept of why build when you can buy and why buy when you can rent. This allows the industry experts to run the backbone of the enterprise, leveraging the latest innovation and expertise. A cloud-based architecture will eliminate the need to focus on project-specific to upgrade individual I.T. stack elements, such as buying new base servers. In addition to the management efficiency, it will bring all DND onto a common platform like the google-drive ecosystem. Then DND would only be responsible for developing and delivering the applications needed by personnel, and more importantly, the warfighters.

16. From a cybersecurity perspective, cloud-based architecture is proven in defence organizations such as the USAF[18]. A cloud-based architecture will present a smaller

[18] U.S. Air Force, *Air Force Continuous ATO Playbook - Constructing a Secure Software Factory to Achieve Ongoing Authority to Operate*Wolf Den Associations, 2018). 5.

perimeter to the adversary by consolidating perimeter firewalls, thus improving defence[19]. The current DND architecture presents a large perimeter for potential intrusion. And given the complexity of some of the network infrastructure, there may be vulnerabilities on the periphery not realized. A cloud architecture would ensure double down on defence where needed and dedicate resources that focus on mission-critical tasks vice patching and mending vulnerabilities of our network. [20]

17. Much of these concepts are not entirely new within DND; we have seen some smaller-scale benefits. For example, DND accelerated a cloud-based solution with Office 365 for enterprise-level collaboration due to COVID-19. However, this only existed at select layers of the technology stack where the applications were *not* managed in a DevOps environment. There are DevOps initiatives underway within various organizations within DND/CAF but there must be overall governance to scale-up these efforts across the entire enterprise and to fully leverage the benefits of the DevOps environment. This is a necessary step for CAF digitization and should not wait until a crisis to take it.

CONCLUSION

18. A DevOps model of digital acquisition is an essential capability that DND needs to implement at the enterprise level. It provides improved agility to deliver capabilities that will keep pace with evolving technology, and enable the CAF to remain competitive in the future threat environment and remain interoperable with our Allies. The DevOps framework will also ensure the capabilities that are delivered to the warfighter are secure, mission-focused and quickly adaptable based on the demands of the environment. Once this foundation is

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[19] Johanna Ullrich et al., "The Role and Security of Firewalls in Cyber-Physical Cloud Computing," *EURASIP Journal on Multimedia and Information Security* 2016, no. 1 (2016), 1-20. 11.

[20] Canadian Center for Cyber Security, *Guidance on the Security Categorization of Cloud-Based Services*, 2020). 49.

established, the CAF can fully realize the benefits of a digitized force and evolve our acquisition process to compete in the new digital ecosystem. This will be the foundation that will accelerate our forces' digitization and enable the C4ISR spine that the VCDS has set as a priority[21].

RECOMMENDATION

19. The following areas are recommended for further analysis to implement an enterprise DevOps model and cloud-based I.T. architecture within DND.

a. Establish a digital services champion and working group to begin investigating the policy reform that will need to occur to make enterprise level changes;

b. Research potential industry partners that could create an experimental DevOps team by leveraging existing DND capabilities and consolidating them under one organization;

c. Initiate an accreditation process for a CAF/DND DevOps department. There should be one CAF/DND DevOps focal point and they need to have the requisite authorities to deliver capabilities continuously; and

d. Collaborate with allies such as the USAF to fuse best practices and leverage binational agreements to evolve an enduring digital acquisition model.

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[21] Rouleau, *VCDS DMA Planning Guidance Data and Digitization*, 2020).

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