

**DEFENSE INNOVATION BOARD**  
**Open Meeting Minutes**  
**July 11, 2018**  
**2:32 PM to 4:58 PM**  
**DIUx, Mountain View, CA**

The Defense Innovation Board (DIB) is a federal advisory committee within the Department of Defense (DoD) operating pursuant to the Federal Advisory Committee Act of 1972, the Government in Sunshine Act of 1976, and other appropriate federal regulations. The DIB meets quarterly and held its seventh public session on July 11, 2018 from 2:32 PM to 4:58 PM in the auditorium of the Defense Innovation Unit Experimental in Mountain View, CA.

**DIB Members (voting)(6)**

Dr. Eric Schmidt (Chair)  
Dr. Richard Murray  
Dr. J. Michael McQuade  
Mr. Milo Medin  
Ms. Jennifer Pahlka  
Ms. Marne Levine  
Mr. Walter Isaacson (Telephonically)  
Mr. Adam Grant (Telephonically)

**DIB Staff Support (non-voting)(7)**

Mr. Joshua Marcuse, Executive Director  
Mr. Michael Gable, Designated Federal Officer  
Ms. Janet Boehnlein  
Captain Christopher Brunett, U.S. Navy  
Ms. Bess Dopkeen  
Ms. Courtney Greenley  
Mr. Aaron Schumacher

**Guest Presenters (3)**

Dr. Michael Hayduk, Chief of Computing and  
Communications Division, U.S. Air Force  
Research Laboratory  
Mr. Brendan McCord, Head of Machine  
Learning, Defense Innovation Unit  
Experimental

**Public Session Attendees (104)**

**Livestream Participants (155)**

**Public Commenters (14)**

Mr. Aman Adhanom  
Mr. Chad Trytten  
Ms. Nupur Mehta  
Mr. Scott Frohman  
Mr. Jason Rathje  
Mr. Glenn Kesselman  
Mr. Justin Mesina  
Mr. Bruce Camber  
Mr. Richard Tippitt  
Mr. Jay Badenhope  
Ms. Anne Laurent  
Mr. Mark Thompson  
Mr. Jordan Wall  
Mr. Norm Abramovitz

## DEFENSE INNOVATION BOARD

### PUBLIC MEETING SESSION

At 2:32 PM, Captain (CAPT) Sean Heritage, acting Managing Partner at the Defense Innovation Unit Experimental (DIUx), welcomed the audience and provide a brief overview of DIUx and their ongoing innovation initiatives. He then turned the meeting over to Mr. Michael Gable, the Designated Federal Officer (DFO), who opened the public meeting and welcomed the members of the audience and those joining over livestream and over the telephone. Mr. Gable turned the meeting over to Mr. Joshua Marcuse.

Mr. Marcuse, Executive Director, introduced the DIB members, thanked DIUx for hosting, and outlined the agenda for the meeting. He then started the discussion on allies and partners and what the Department is doing to strengthen its alliances. He recounted the Board's visits to other countries, particularly its latest visit to the United Kingdom, Belgium, and Germany, and asked the Board to deliberate on two questions. First, how might the U.S. advance innovation by enhancing collaboration with allies and partners? Second, how do we deepen these crucial alliances and partnerships by using the same tools that the board members have been recommending to the United States? That is, how can the Board's recommendations to the Department on innovation be used to make our allies and partners stronger? Mr. Marcuse then turned the meeting over to Dr. Eric Schmidt.

Dr. Schmidt, Chairman of the Board, thanked Mr. Marcuse and CAPT Heritage for hosting. He urged the audience to read the National Defense Strategy (NDS), and reiterated how grateful the Board is to be able to service the Department. He praised DIUx and then briefly touched on the DIB's trips to the UK Ministry of Defense (MoD), the headquarters of the North Atlantic Treaty Organization (NATO), and U.S. Africa Command (AFRICOM) and U.S. European Command (EUCOM) in Germany. Dr. Schmidt then turned the meeting back over to Mr. Marcuse.

Mr. Marcuse opened the discussion to other board members for deliberation on how the U.S. might advance its agenda regarding allies and partners.

Dr. Richard Murray started by observing that the U.S. no longer operates on its own. That is, the U.S. always operates in a coalition, which requires figuring out how to integrate not only the systems that are part of partners' operating mechanisms, but also the cultural and organizational elements. He posed that using software to connect people and systems together will be an interesting issue to tackle.

Dr. Michael McQuade added that the DIB has a strong mentality that says: don't try and get everything done perfectly; don't wait until you have all the requirements done; and don't wait until you have the exact plan. Go, do, try, work, cycle, fix, and iterate. He also noted that the U.S. and its partners don't have to be doing the same experiments, which presents the opportunity for more innovations.

Mr. Milo Medin noted the dedication he saw from the DIB trips – of people overcoming great challenges in terms of information sharing and having to work together on a joint mission. He said that one of the big challenges is figuring out how to get security and identity management

## DEFENSE INNOVATION BOARD

and compartmentalization of information done properly across the broad Allied enterprise, mirroring the sort of challenges seen in the commercial industry today.

Ms. Marne Levine added that the DIB's international engagement has been really valuable in terms of highlighting some of the issues the Board has grappled with such as acquiring new talent and expanding STEM capabilities within the Department. She wondered if there was a way for the Department's foreign installations to expand existing authorities around hiring local nationals to bring on local tech talent to help with select projects.

Dr. Murray also commented on the way the UK MoD organizes and funds their innovation activities. Specifically, on how their chief innovation officer uses a dedicated source of innovation funding, in collaboration with Services leaders, to incite new projects at an accelerated rate.

Mr. Marcuse then turned the meeting to Ms. Bess Dopkeen to talk about the Board's congressionally-mandated Software Acquisition and Practices (SWAP) study. Ms. Dopkeen gave a quick summary of the SWAP's mandate, objectives, and background. Particularly, she noted the assumption that the Department has tons of great data, and simply needs help with software to analyze it all. However, she emphasized that there is a much larger cultural and structural problem. The Department's leadership relies on experienced and trusted advisers to synthesize and make use of critical data by hand because timely, authoritative data is not collected nor made readily available for advanced analytics. The Department has no real acquisition data system that holds anything more than top-level data on its largest programs.

To that end, Ms. Dopkeen briefly introduced the Board's set of preferable metrics that would enable data analysis to allow the Department to compare software projects going forward; determine which software acquisition strategies are best; harness the power of more efficient practices; better predict the cost of systems; provide program managers with credible program projections; provide the contracting acquisition process with more insight to negotiate contracts and identify when programs are on the path to success or failure; and allow the Department to make better and faster decisions. Ms. Dopkeen then turned the meeting over to Dr. Murray and Dr. McQuade (SWAP study co-chairs) to talk about the metrics.

Dr. McQuade started the discussion by posing two guiding principles for the SWAP study. First, the Department should not acquire or develop software like hardware. Second, hardware should be bought more like software. He then provided a brief explanation of the Board's four categories of software: commercial off-the-shelf software; commercial software with customization; custom software on commodity hardware; and custom software on custom hardware. He then turned the conversation over to Dr. Murray.

Dr. Murray gave a brief overview of the Board's approach to the study. He emphasized the importance of speaking with users in the field -- in combatant commands and other military installations and the people who are developing software, both within the industry and within the Services. He noted that these engagements helped the Board understand the differences between how the Department and industry approach software.

## DEFENSE INNOVATION BOARD

Dr. Murray then re-emphasized Ms. Dopkeen's comments about the Department's lack of software metrics and discussed the Board's four categories of software measurements: (1) deployment rate; (2) response rate; (3) code quality; and (4) practices in managing, assessing, and estimating the cost of software.

Dr. McQuade then discussed the first category (deployment rate). He outlined the three metrics in this category: (1) the time from program launch to deployment of the simplest useful functionality; (2) time to field high priority functions or fix newly found security holes; and (3) time from code committed to code in use.

Mr. Medin added that there are a lot of implications for these kinds of metrics. In particular, given that compute is changing dramatically over time, the Department should be designing weapons systems in a way that the compute elements can be upgraded frequently.

Dr. Schmidt also added that though this is a software study, the fact of the matter is that the hardware is way behind.

Ms. Levine then reiterated the importance of getting the metrics right. She said there is an age-old lesson of being focused on the right metrics because people will chase the metrics, even if they are the wrong metrics. She also mentioned the importance of culture, modern compute infrastructures, and creating an environment that enables smaller teams to ship software updates faster.

Ms. Jen Pahlka affirmed Ms. Levine's point, and then stressed the importance of having measurements that also validate the usefulness of software and empowering end users to provide that critical feedback.

Dr. Schmidt then asked if any of the board members joining via phone had comments.

Mr. Walter Isaacson suggested that the Board discuss at a later point how the U.S. could help its allies with developing modern software capabilities, and Dr. Schmidt agreed that this idea would be useful to consider in future discussions.

Dr. Adam Grant noted that roughly 20 percent of all the value-added collaborations and software-focused jobs come from just 3 to 5 percent of the people, who are excellent problem solvers and boundary setters, and metrics don't always capture that behavior. He emphasized that the Board should consider software measurements that capture collaborative impact and not just individual productivity.

Dr. Murray then continued the discussion on the categories of metrics, specifically on the response time to cyber vulnerability. This includes: (1) time required for full regression testing and cybersecurity audit and penetration testing, and (2) the time required to restore service after outage.

Mr. Medin added that software doesn't just mean the application but also encompasses the platform that the application runs on, including operating system firmware. This may require

## DEFENSE INNOVATION BOARD

new models of collaboration – for example, how does the Department test a system if the code for separate modules are held separately? The Department will most certainly have to virtualize the environments to be able to run large number of tests in parallel, otherwise it will be difficult for large collections of compute to test effectively.

Ms. Levine added the importance of having a framework. She said it's important to have a prioritization system for dealing with incidents as they arise and a mechanism for identifying who comes to the table to deal with things in real-time.

Dr. McQuade then continued with code quality metrics, including: (1) automated test coverage of code; (2) number of bugs caught in testing versus field use; (3) change failure rate (how often the code is rolled back); and (4) percent of code available to DoD for inspection and rebuild.

Ms. Pahlka stated that the number of bugs caught in testing versus field use is an interesting metric because it will drive a behavior that brings the development and testing environment closer to field users. She emphasized that it is important to track whether that actually happens to assess the value of that metric and its ability to promote new, desirable behaviors in the development and deployment of software capabilities.

Mr. Medin added that the Board should also consider the trajectory of software. Early on in a program, there is a higher percentage of bugs that may be found, but one of the characteristics of mature code is that the amount of bugs and defects reduces over time.

Dr. Schmidt posited that DoD software developers tend not to use GitHub. Mr. Medin concurred. Dr. Schmidt then suggested to have a metric that captures the number of DoD pieces of software where one programmer is checked by another, which currently could be zero. The Board largely agreed.

Dr. Murray continued with the metrics around program management, assessment, and estimation. These include: (1) the number and types of structures for specifications, code, and development and execution platforms; (2) the structure of development environments and operational use; and (3) the “Nunn-McCurdy” threshold. Dr. Murray then opened for feedback from the Board.

Dr. Schmidt suggested that the metrics may be too broad. He said even the best teams can't predict how long things will take, and so if metrics imply that it's possible, they may set up a false incentive. He also suggested a metric that measures the Department's relevance in software. That is, a list that includes languages, hardware and software packages, and development packages used in the past five years and measure how the Department conforms to that list.

Mr. Medin added that how slowly something is being built should also be measured. He used designing the F-35 in 2001 as an example.

Ms. Levine then suggested that the Board consider if there was a way to capture how any of these metrics trade off against other priorities.

## DEFENSE INNOVATION BOARD

Dr. Murray then outlined some of the changes Congress needs to make in order to enable the Department to implement software at the level that is consistent with the rate of which technology is changing.

Ms. Pahlka noted that it's not just the DoD but the whole of government that has a problem with software. Mr. Medin concurred.

Mr. Marcuse asked Dr. Schmidt if the best approach is to make a list of the obsolete programming languages and make the Department accountable or to report on the adoption of modern conventions and practices.

Dr. Schmidt emphasized that the priority is on getting to modernity, as defined by practices and conventions of the last five years. However, he said reaching modernity is often impeded by rules.

Mr. Marcuse then turned the meeting over to Dr. Michael Hayduk, Chief of the Air Force Research Laboratory's Computing and Communications Division, to talk about quantum sciences.

Dr. Hayduk thanked the Board for having him. He briefly described what quantum information science is and how DoD can exploit the quantum mechanical properties of both light and atomic system for enhanced applications. In terms of new capabilities and where the Department is going, quantum information science is broken into four key areas: timing, sensing, communications, and computing. Each of those has a different time frame in terms of when they are going to be more mature.

Dr. Hayduk touched on quantum-enabled capabilities such as, secure communications, long-duration inertial navigation in GPS-denied environments, bunker and tunnel detection, and time transfer and synchronization among different platforms. He said there is large international investment, citing the UK's four quantum hubs beginning in 2008, with about \$400 million equivalent to development funding. The European Union is investing \$1 billion into what they are calling their quantum flagship over a ten-year period. Lastly, China has committed \$10-15 billion over a five-year period in quantum sciences.

Dr. Hayduk also summarized events that the Air Force held this year such as a quantum coordination meeting in April, a quantum summit with the Vice Chief of Staff of the Air Force and the major commands, and a quantum innovation summit with key academia and industry thought leaders.

Dr. Hayduk then updated the audience on what the Air Force was doing in quantum timing, sensing, communications, and computing. He conceded there tends to be a lot of hype in quantum, and noted the need for more basic research. He then briefly talked about issues with recruiting talent, supply chain development, the National Quantum Initiative proposed by Congress, and engagement with international partners. He concluded by saying the Air Force cannot do this alone and will need a coordinated effort in the field of quantum.

## DEFENSE INNOVATION BOARD

Mr. Marcuse asked for comments from the Board. Mr. Medin offered that one of the challenges that quantum computing poses is the ability to get enough qubits to execute Shor's algorithm effectively, which cuts at the very heart of the security of our cryptographic systems.

Dr. Schmidt emphasized that the most important thing is to move everyone, including DoD, to quantum-resistant key exchanges.

Mr. Marcuse turned the meeting to Mr. Brendan McCord, head of machine learning at DIUx, to talk about artificial intelligence (AI). Mr. McCord opened with the establishment of the Joint Artificial Intelligence Center (JAIC) and the implications of AI for defense. He emphasized that AI has the potential to be an enabling layer across nearly all aspects of the Department, from the way equipment is maintained, environments are perceived, how men and women are protected, how networks are defended, and how humanitarian aid is provided for disaster relief efforts.

Mr. McCord also highlighted four general themes regarding the establishment of JAIC: (1) to improve critical decision-making capabilities and to do so at the pace of technology advancement; (2) to assist the Department to evolve its partnerships with industry, academia, allies, and partners; (3) to attract and cultivate a select group of mission-driven, world-class AI talent and assist in Department-wide efforts to develop and prepare its work force more broadly; and (4) to keep the peace, deter war, protect the United States, and improve global stability.

Dr. Schmidt thanked Mr. McCord and congratulated him, emphasizing that this has occurred brilliantly fast for DoD. He then asked the Board for comments.

Dr. McQuade congratulated the Department and Mr. McCord for the speed of establishing the JAIC and for recognizing the broader context around talent, training, and principles.

Mr. Medin added that he thinks the JAIC has the ability to improve the quality of decision-making in the Department.

Dr. Schmidt then asked Mr. Isaacson if he had any comments. Mr. Isaacson commented that the Board should consider the impact of AI, software, and cybersecurity in creating and strengthening alliances. He posited that greater collaboration with allies will allow the U.S. to better compete with China.

Dr. Murray commented that the Department needs to spend some time understanding how to implement AI in safety-critical systems. He used self-driving cars as an example.

Mr. Marcuse then reminded the audience about the comment cards and transitioned to the DoD implementation update. He highlighted the Defense Digital Service teaming up with Army Cyber Command to develop with a new way to train its personnel. They worked with General Assembly to institute a "blended learning" curriculum to accelerate training for cyber operators. They cut it in half, and the early reports indicate that the participants in the pilot study are actually outperforming the students in the more traditional classroom model.

He then highlighted the Strategic Capabilities Office on improving readiness in jets and the

## DEFENSE INNOVATION BOARD

Army with the launch of a new initiative designed to accelerate the transition of emerging technologies from research to production by creating a new fund for select projects and expediting approvals from top acquisition officials. Other Transaction Authorities (OTAs) were mentioned, and Mr. Marcuse gave credit to CAPT Heritage and the DIUx team for modeling the use of OTAs to speed up acquisition processes. He recognized Major General James Young, U.S. Army for standing up the 75<sup>th</sup> Innovation Command and being the Army's representative to the DIB for the coming year. Mr. Marcuse also recognized the U.S. Marine Corps for creating the new Deputy Commandant for Information, Army's National Guard Intelligence Center for moving to cloud solutions, Major General Kimberly Crider, U.S. Air Force for the Air Force's progress on a Service-wide data strategy, and the Office of the Chief Management Officer's sponsorship of a three-day executive education course on managing innovation.

Dr. Schmidt thanked Mr. Marcuse for the update.

Mr. Marcuse then transitioned the meeting to public comments.

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### PUBLIC COMMENTS

Mr. Aman Adhanom from a startup in the Bay Area commented on figuring out how to engage with the Department. He wondered to what extent DoD has looked into DHS's Silicon Valley innovation program to facilitate engagement with startups.

Mr. Chad Trytten affirmed Mr. Schmidt's words to not set up a team for failure by giving them something that is unrealistic.

Ms. Nupur Mehta from RigPlenish expressed her excitement being at the meeting and wanted to get more information of the kinds of problems DoD is trying to digitalize and how to get in touch.

Mr. Scott Frohman thanked the Board for its work and is excited about the JAIC. He expressed that there is a greater degree of alignment between the Silicon Valley and the Department in terms of ethics around AI. He encouraged the Board to work with industry on ethical questions.

Mr. Jason Rathje, a graduate student, expressed that one of the largest gaps in acquisitions today is the connection between the acquisition service and the user community. He didn't see any metric that directly assessed user feedback or adoption rates within the user community.

Mr. Glenn Kesselman said he was really excited to see the work around AI and wanted to see what the Board is doing in the cybersecurity realm.

Mr. Justin Mesina with the National Geospatial Agency brought up two points to consider, First, how much does the DoD recognize the software approval and accreditation processes done by the other Services and agencies? Second, how much or how little does the DoD audit its processes?

## DEFENSE INNOVATION BOARD

Mr. Bruce Camber concluded that most of the problems within the DoD are when the foundations of understanding are not known and not mutually shared or not specified.

Mr. Richard Tippitt, deputy chief of product for Kessel Run, thanked the Board. He cautioned the Board to not be too prescriptive with how they relayed processes to the Department because sometimes the Department codifies those processes to the point of being unproductive.

Mr. Jay Badenhope, product manager with Pivotal, affirmed Ms. Levine's point to get the empathy and emotion the same way with a commercial product. He affirmed Dr. Murray's comment on paired programming.

Ms. Anne Laurent with the Acquisition Innovators Hub thanked the Board and talked about OTAs and the need for a centralized place for information on transactional authorities.

Mr. Mark Thompson with SWIM AI based in San Jose, CA commented on the excitement going on around AI and asked how will the JAIC measure its progress.

Mr. Jordan Wall, an acquisition officer in the U.S. Air Force, asked the Board to look at the incentives given to the prime contractors.

Mr. Norm Abramovitz from Stark & Wayne commented that the Board's metrics should include measurements on the operations side of things.

CAPT Heritage encouraged the audience to apply for DIUx's CSOs and to engage in conversation.

Dr. Schmidt made closing comments and Mr. Marcuse concluded the meeting.

END OF PUBLIC SESSION

ADJOURNMENT

Mr. Marcuse, with the concurrence of the ADFO, adjourned the DIB's April 26, 2018 public meeting session at 4:58 PM.

I hereby certify, to the best of my knowledge, the foregoing minutes are accurate and complete.

  
Eric Schmidt, Ph.D.  
Chairman, Defense Innovation Board

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### PARTICIPANT LIST:

Joseph Aghia  
Sunny Ahn  
Alina Ainbinder  
David Altschuga  
David Altschuler  
Ian Andrews  
Balint Antal  
Rhian Anthony  
Hugo Arellano  
Samira Asgari  
Brandon Avila  
Ernie B.O.  
Christian Bailey  
Sara Balch  
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Philip Budden  
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Christopher Cadigan  
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Anita Carleton  
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Bridget Chak  
Alina Chan  
Eric Chase  
Gabrielle Chefitz  
Fiona Chen

Haiqi Chen  
Jennifer Chen  
Michael Chieh  
Michael Chien  
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Eamon Comer  
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Khajanovia Dautry  
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Shawn Egri  
Shawn Egri  
Oana Enache  
Matt Epperly  
Matt Epperly  
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Henry Ferrara  
Melissa Flagg  
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Holly Foskett  
Cara Fraley  
Catherine Freije

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Adam Furtado	Johanna Jones
Victoria Galvin	Vinay Kartha
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Liz Gaskell	John Kennedy
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Riaz Gillani	Gene Keselman
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Travis Golly	Christina Kirk
Adam Goobic	Will Kirkman
Adam Goobic	Jake Kloeber
Elana Gordy	Jessica Klopp
Robert Green	Eric Kofman
Anna Greka	Sara Kosmaczewski
Shari Grossman	Kunal Kothari
Gail Guo	Bruce Kozuma
Kane Hadley	Karen Krause-Bencal
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Brendan Hanks	Matthew Krimm
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Chris Harrison	Lindsey Kroger
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Poul Hebsgaard	Vikram Kumra
Vivian Hecht	Dan Kurtenbach
Sean Heritage	Rizwan Ladha
George Herz	Gwen Lamar
Orn Hessfin	Jen Lapan
Brandon Hicks	Daniel Leary
Li-Lun Ho	Samuel Lee
Zandra Holland	Soo Hee Lee
Kara Holmquist	Mitchell Leibowitz
Jagmohan Hooda	Maggie LeMaitre
Abby Hopper	Evan Lemire
Yi-Hsiang Hsu	Rachel Liao
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Margaret McKenna	Alexis Prest-Simpson
Robert Meffan	Megan Purdum
Nehal Mehta	Leanne Quinn
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Arman Mohammad	Pete Roney
Linda Moineau	Pete Roney
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James Mullahoo	Oliver Ruebenacker
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Patrick Murray	Ali Saaem
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Bhavik Nagda	Alexandra Sander
Vasant Nagda	Christine Santoro
Raghu Nandan	Jean Santos
Waseem Naqvi	Michael Scollo
Anjali Nath	Douglas Scott
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