

Modernizing DoD Software Production

Jeff Boleng, OUSD(A&S), Special Assistant for Software Acquisition

Guidance and Advice

“We want to develop contracts to support Agile DevOps software development. Our systems need to be hardware-enabled and software-defined. Software development processes are different than traditional production, development and sustainment processes for weapons systems. We need a software color of money.”

“We have to get a lot better, faster, more agile”

“Implementation of some of the study's recommendations, such as the creation of new acquisition pathways for software and a new mechanism for authorization to operate reciprocity, are already under way.”

“Security is a first order consideration. We need to create a secure environment that supports DevSecOps for big defense contractors and small innovative companies.”

“Software development requires different skill sets. We need to change how we train and maintain talent. We need to develop centers of excellence with broad reach across the acquisition and operational communities.”

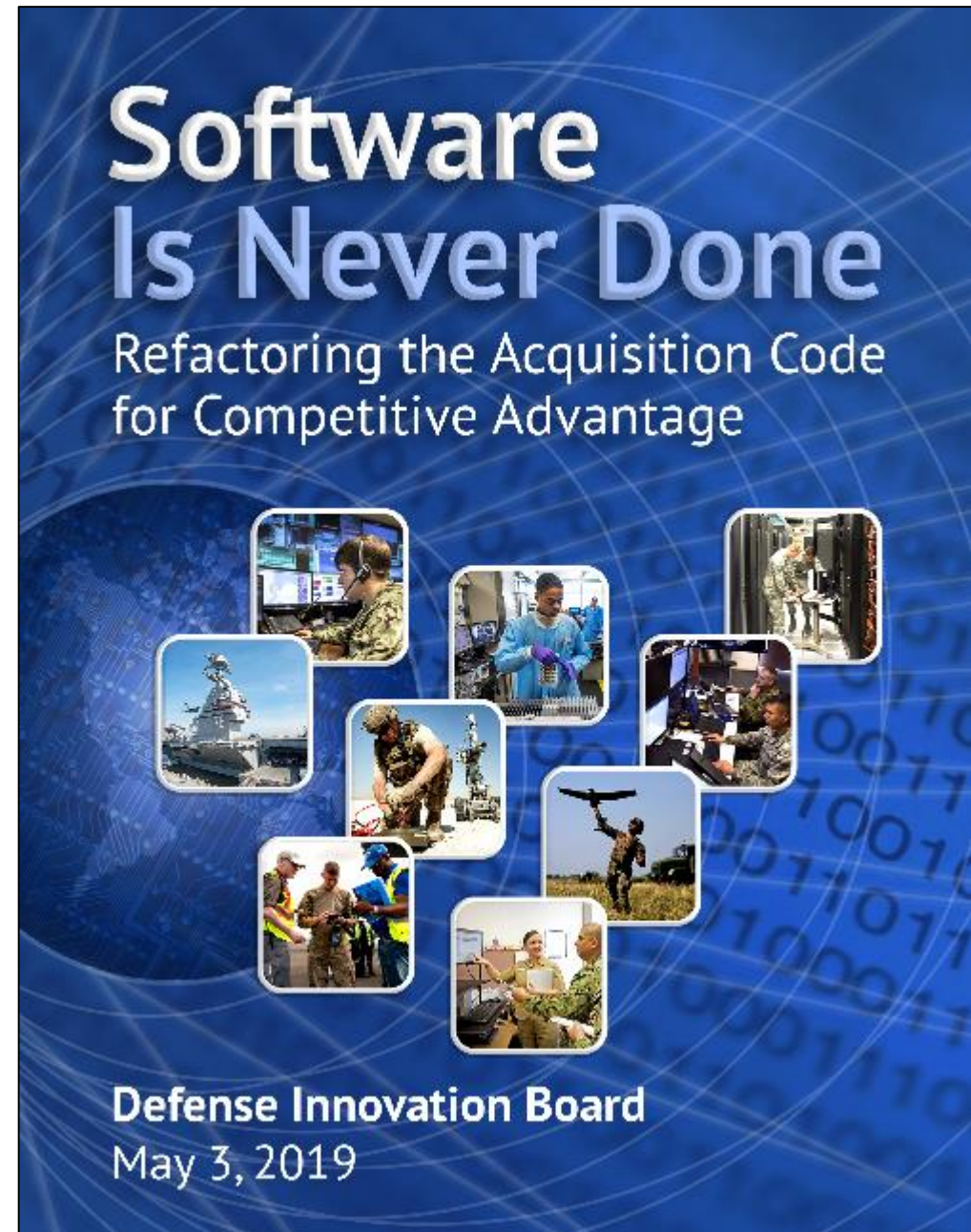


HON Ellen Lord, USD(A&S)

“I am committed to creating a culture of creative compliance, scaling innovation from pockets of excellence, and mainstreaming authorities provided by Congress.”

“Defense technological advantage today is enabled by hardware, but its capability is defined by software. There is an undeniable urgency to develop and deploy software faster, faster than our adversaries, in order to maintain strategic and tactical advantage.”

Guidance and Advice



Advice and Guidance

DEPARTMENT OF DEFENSE | DEFENSE SCIENCE BOARD

Appendix C: Recommendations

Recommendation 1: Software Factory

A key evaluation criterion in the source selection process should be the efficacy of the offeror's software factory.

The Under Secretary of Defense for Research and Engineering (USD(R&E)) should immediately task the Defense Digital Service (DDS), the U.S. Air Force Life Cycle Management Center (LCMC), the Software Engineering Institute (SEI) Federally Funded Research and Development Center (FFRDC), the U.S. Naval Air Systems Command (NAVAIR), and the Army Materiel Command (AMC) to establish a common list of source selection criteria for evaluating software factories for use throughout the Department (see Appendix E for suggested draft criteria). To be considered minimally viable for a proposal, competing contractors should have to demonstrate *at least* a pass-fail ability to construct a software factory. The criteria should be reviewed and updated every five years.

The DoD has limited iterative development expertise. Focusing this expertise during source selection uses this limited talent in the most efficient way.

Recommendation 2: Continuous Iterative Development

The DoD and its defense industrial base partners should adopt continuous iterative development best practices for software, including through sustainment.

The Service Acquisition Executives (SAE), with the program executive officers (PEOs), the program managers (PMs), and the Joint Staff/J-8, should, over the next year, identify minimum viable product (MVP) approaches and delegate acquisition authority to the PM (cascade approach), providing motivation to do MVP and work with the users to:

- deliver a series of viable products (starting with MVP) followed by successive next viable products (NVPs);
- establish MVP and the equivalent of a product manager for each program in its formal acquisition strategy, and arrange for the warfighter to adopt the initial operational capability (IOC) as an MVP for evaluation and feedback; and
- engage Congress to change statutes to transition Configuration Steering Boards (CSB) to support rapid iterative approaches (Fiscal Year (FY) 2009 National Defense Authorization Act (NDAA), Section 814).

The Defense Acquisition Executive (DAE) and the SAE or the Milestone Decision Authority (MDA) (i.e., PEO or PM) should require all programs entering Milestone B to implement these iterative processes for Acquisition Category (ACAT) I, II, and III programs. The goal is not to be overly prescriptive, and the details should be tailored to each program. Progress should be made on this action by summer 2018.

DSB Task Force on Design and Acquisition of Software for Defense Systems

Appendix C | C-1

DSB Task Force on Design and Acquisition of Software for Defense Systems

Appendix C | C-3

DSB Task Force on Design and Acquisition of Software for Defense Systems

Appendix C | C-4

DSB Task Force on Design and Acquisition of Software for Defense Systems

Appendix C | C-5

The Ten Most Important Things to Do (Starting Now!)

Line of Effort A (Congress and OSD): Refactor statutes, regulations, and processes for software

- A1** Establish one or more new acquisition pathways for software that prioritize continuous integration and delivery of working software in a secure manner, with continuous oversight from automated analytics
- A2** Create a new appropriation category for software capability delivery that allows (relevant types of) software to be funded as a single budget item, with no separation between RDT&E, production, and sustainment

Line of Effort B (OSD and Services): Create and maintain cross-program/cross-Service digital infrastructure

- B1** Establish and maintain digital infrastructure within each Service or Agency that enables rapid deployment of secure software to the field, and incentivize its use by contractors
- B2** Create, implement, support, and use fully automatable approaches to testing and evaluation (T&E), including security, that allow high-confidence distribution of software to the field on an iterative basis
- B3** Create a mechanism for Authorization to Operate (ATO) reciprocity within and between programs, Services, and other DoD agencies to enable sharing of software platforms, components, and infrastructure and rapid integration of capabilities across (hardware) platforms, (weapon) systems, and Services

Line of Effort C (Services and OSD): Create new paths for digital talent (especially internal talent)

- C1** Create software development units in each Service consisting of military and civilian personnel who develop and deploy software to the field using DevSecOps practices
- C2** Expand the use of (specialized) training programs for CIOs, SAEs, PEOs, and PMs that provide (hands-on) insight into modern software development (e.g., Agile, DevOps, DevSecOps) and the authorities available to enable rapid acquisition of software

Line of Effort D (DoD and industry): Change the practice of how software is procured and developed

- D1** Require access to source code, software frameworks, and development toolchains—with appropriate IP rights—for DoD-specific code, enabling full security testing and rebuilding of binaries from source
- D2** Make security a first-order consideration for all software-intensive systems, recognizing that security-at-the-perimeter is not enough
- D3** Shift from the use of rigid lists of requirements for software programs to a list of desired features and required interfaces/characteristics to avoid requirements creep, overly ambitious requirements, and program delays

Chapter 5 provides additional context and Appendix A contains draft implementation plans.

DIB SWAP FOUR LINES OF EFFORT

A. Refactor statutes, regulations, and processes for software



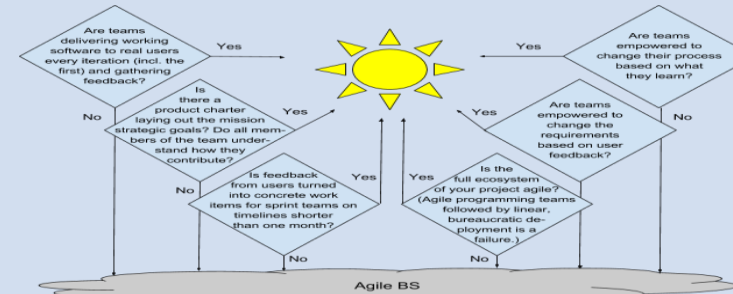
B. Create and maintain cross-program/ cross-service digital infrastructure



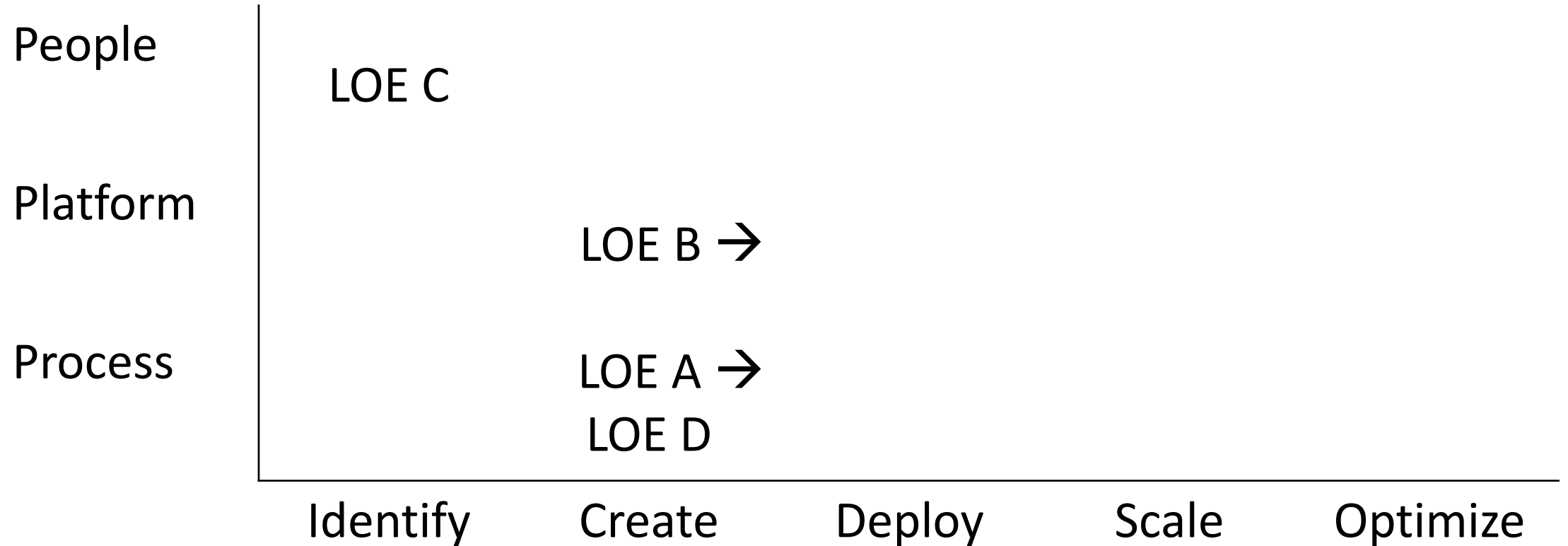
C. Create new paths for digital talent (especially internal talent)



D. Change the practice of how software is procured and developed



People, Platform, Process



LOE Executive Champions

People



JOSE M. GONZALEZ
Executive Director,
Human Capital Initiatives

Platform



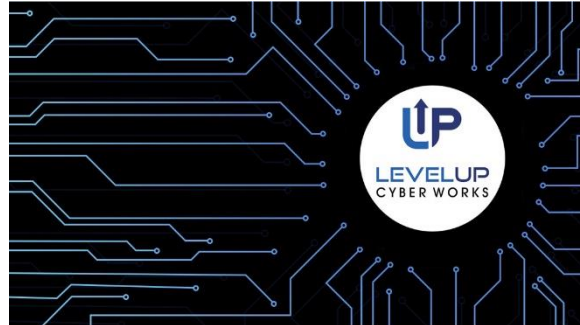
Peter T. Ranks
Deputy Chief Information Officer for
Information Enterprise (DCIO(IE))

Process



Stacy Cummings
Principal Deputy Assistant Secretary of
Defense, Acquisition Enablers at United
States Department of Defense

People



Kessel Run in Massachusetts
Space Camp in Colorado
BESPIN in Alabama
Rogue Blue in Nebraska
Kobyashi Maru and
Section 31 in California
LevelUP in Texas



- Identify high performing SW development activities across Services and 4th estate
- Create a forum for sharing of best practices
 - Contracting
 - Recruiting, hiring, retaining
 - Training and education
 - Estimating
 - Project management
- NDAA-18 873/874 Agile Pilots
- KLP for Software Architect
- Hiring authorities



Railgun
Catapult

NAVWAR



People



- Education and Training
 - Surveying available courses
 - Modernizing content
 - In search of vignettes, lessons learned and best practices

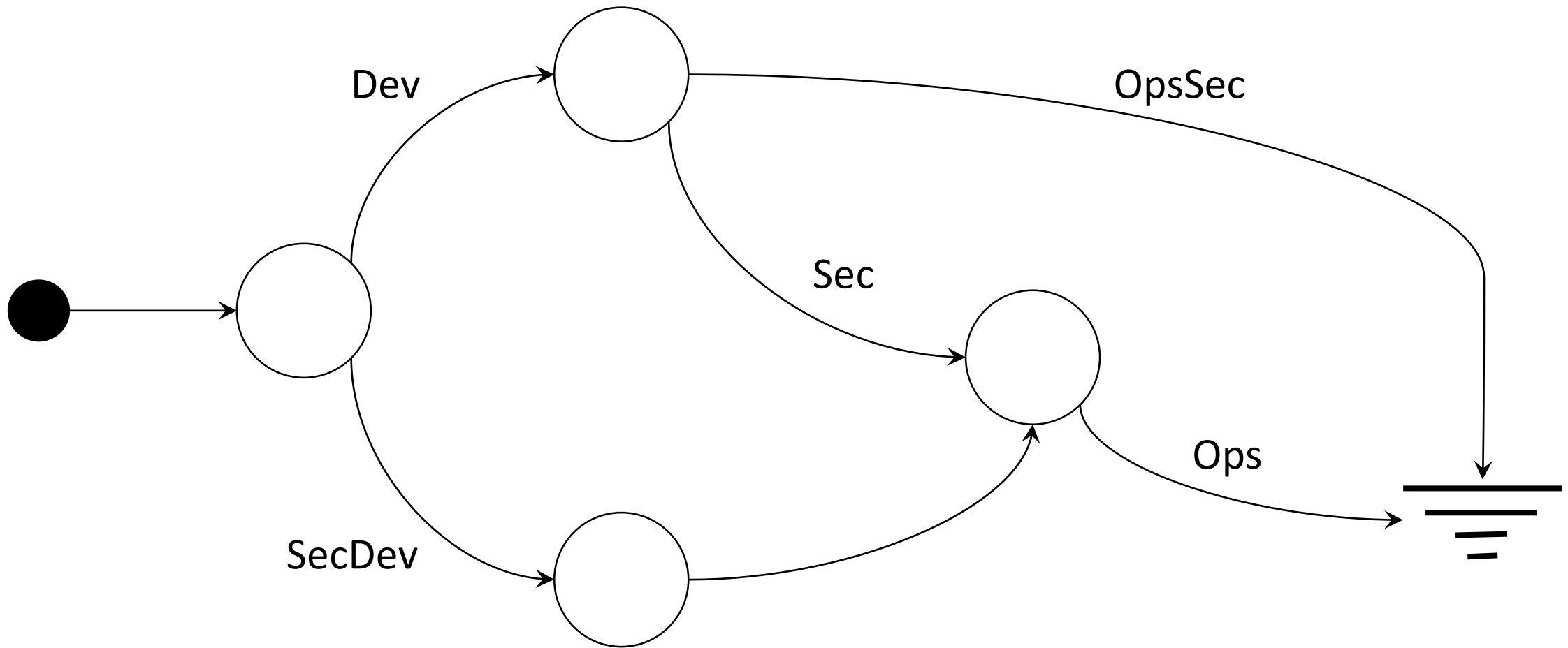


Platform

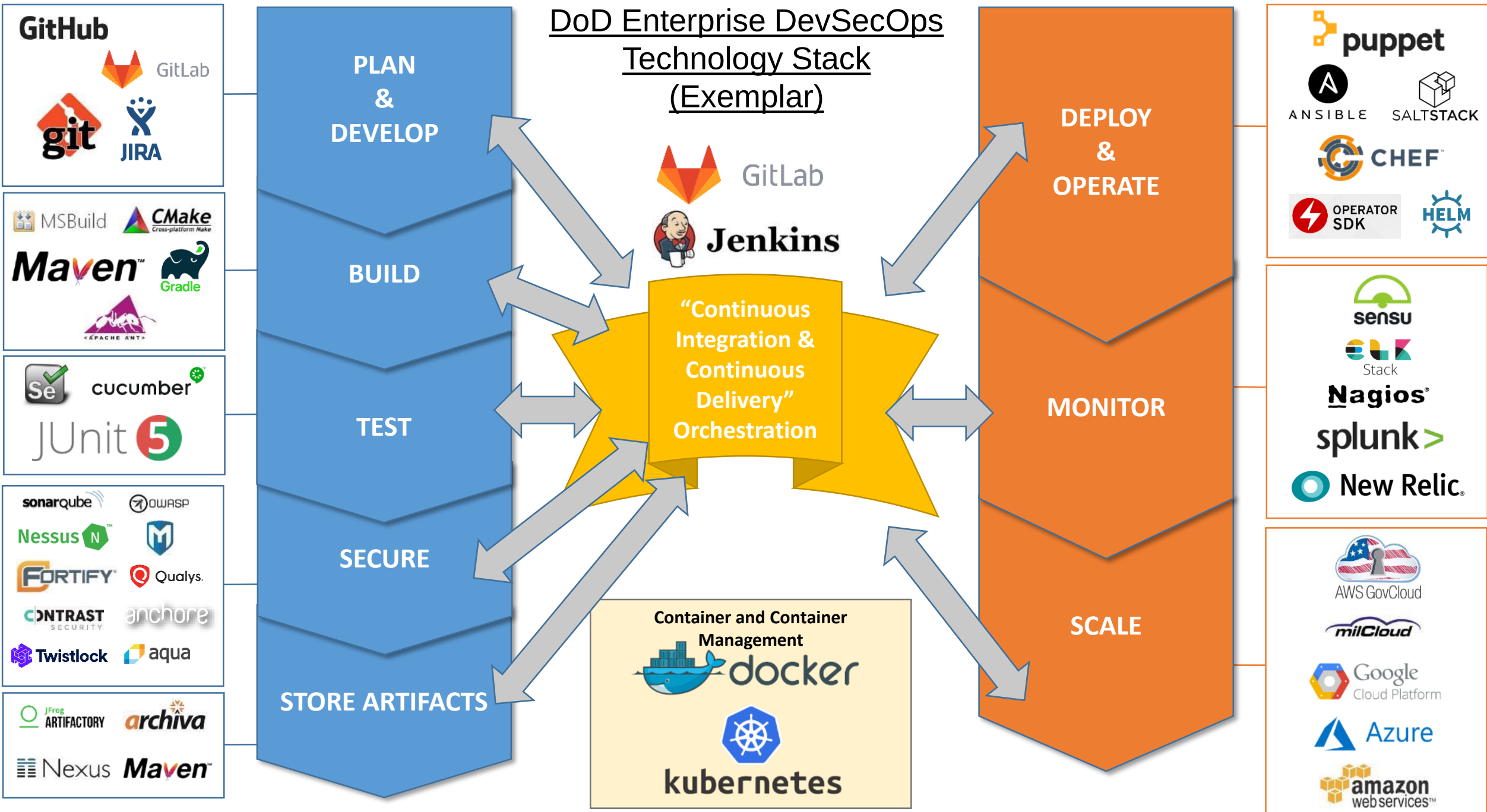


Enterprise DevSecOps

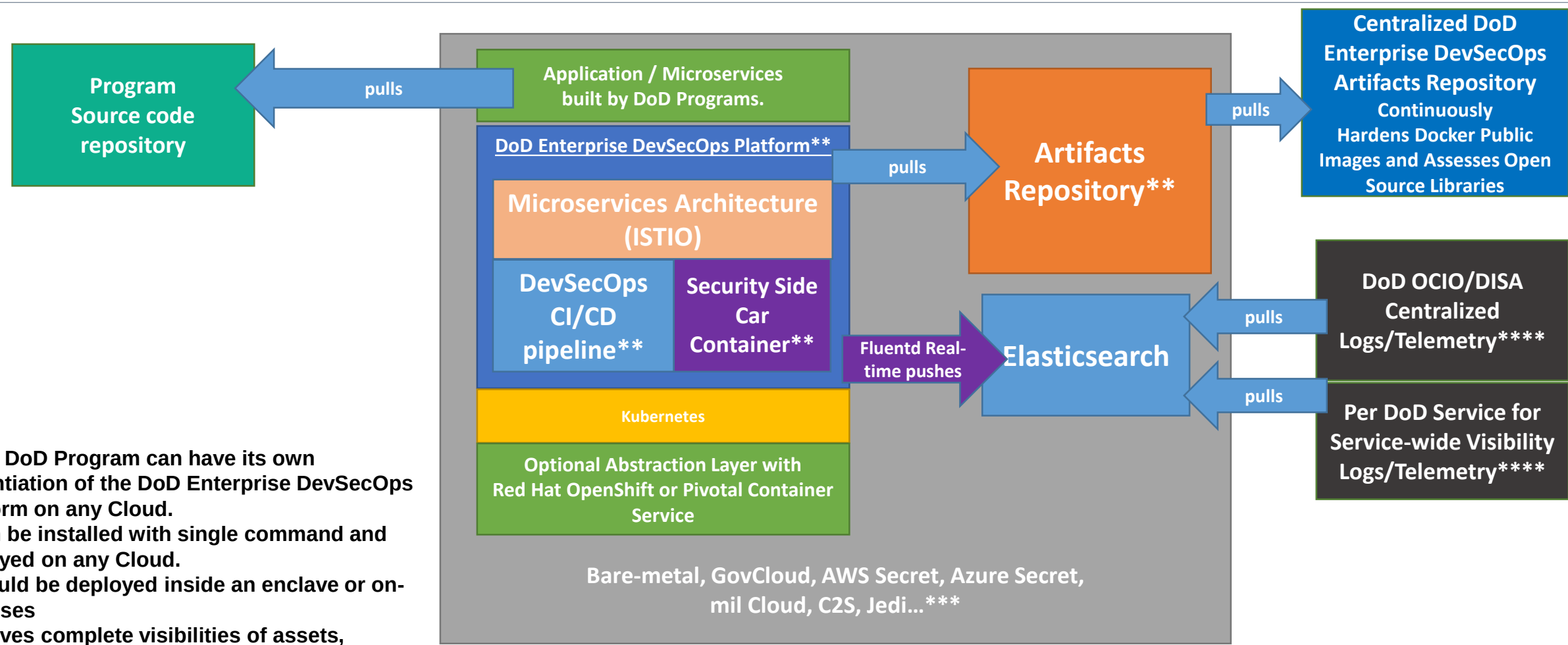




? [SecDevOps | DevSecOps | DevOpsSec] ?



DoD Enterprise DevSecOps Architecture*



*each DoD Program can have its own instantiation of the DoD Enterprise DevSecOps Platform on any Cloud.
** can be installed with single command and deployed on any Cloud.
*** could be deployed inside an enclave or on-premises
**** gives complete visibilities of assets, security/vulnerability state etc. can be integrated to existing cybersecurity shared services.

What to measure (process & quality)?

- “DORA four” (DevOps Research and Assessment)

- Deployment Frequency
- Lead time for changes
- Mean time to recover
- Change failure rate

Speed and Stability: You Can Have Both

Survey questions	High IT performers	Medium IT performers	Low IT performers
Deployment frequency <i>For the primary application or service you work on, how often does your organization deploy code?</i>	On demand (multiple deploys per day)	Between once per week and once per month	Between once per week and once per month*
Lead time for changes <i>For the primary application or service you work on, what is your lead time for changes (i.e., how long does it take to go from code commit to code successfully running in production)?</i>	Less than one hour	Between one week and one month	Between one week and one month*
Mean time to recover (MTTR) <i>For the primary application or service you work on, how long does it generally take to restore service when a service incident occurs (e.g., unplanned outage, service impairment)?</i>	Less than one hour	Less than one day	Between one day and one week
Change failure rate <i>For the primary application or service you work on, what percentage of changes results either in degraded service or subsequently requires remediation (e.g., leads to service impairment, service outage, requires a hotfix, rollback, fix forward, patch)?</i>	0-15%	0-15%	31-45%

* Note: Low performers were lower on average (at a statistically significant level), but had the same median as the medium performers.

What to measure (operations)?

- Google four golden signals
 - **Latency** – time it takes to service a request or report an error
 - **Traffic** – how much demand is being placed on your system
 - **Errors** – rate of requests that fail (explicitly, implicitly (incorrect return value), and by policy)
 - **Saturation** – how “full” your service is (fraction of system/component saturation)



Image Source: <https://twitter.com/torkelo/status/849248155073990656>

Source: <https://landing.google.com/sre/sre-book/chapters/monitoring-distributed-systems/>

What to measure (product)?

- Is this software useful?
 - How many people use the software?
 - How often is the software used (daily/weekly/monthly)?
 - Which feature are most used?
 - Does a change reduce the time to complete a workflow/task?
 - Does a change increase the accuracy of a workflow/task?
- Is this software easy to use?
 - How long does it take to learn this software?
 - What is the variance in time to complete a workflow/task across users?

Why is this so hard?



Program Manager

Contract and Incentives

Developer



PEO



Program Manager

Contract and Incentives

Developer



Service Acquisition
Executive



PEO



Program Manager

Contract and Incentives

Developer



Congress

FAR, NDAA, Appropriations Bill, Statute



OSD

DFAR, 5000 series



Service Acquisition Executive

Service Acquisition Regulations



PEO



Program Manager

Contract and Incentives

Developer

Where is the Operational User?



Congress

FAR, NDAA, Appropriations Bill, Statute



OSD

DFAR, 5000 series



Service Acquisition Executive

Service Acquisition Regulations



PEO

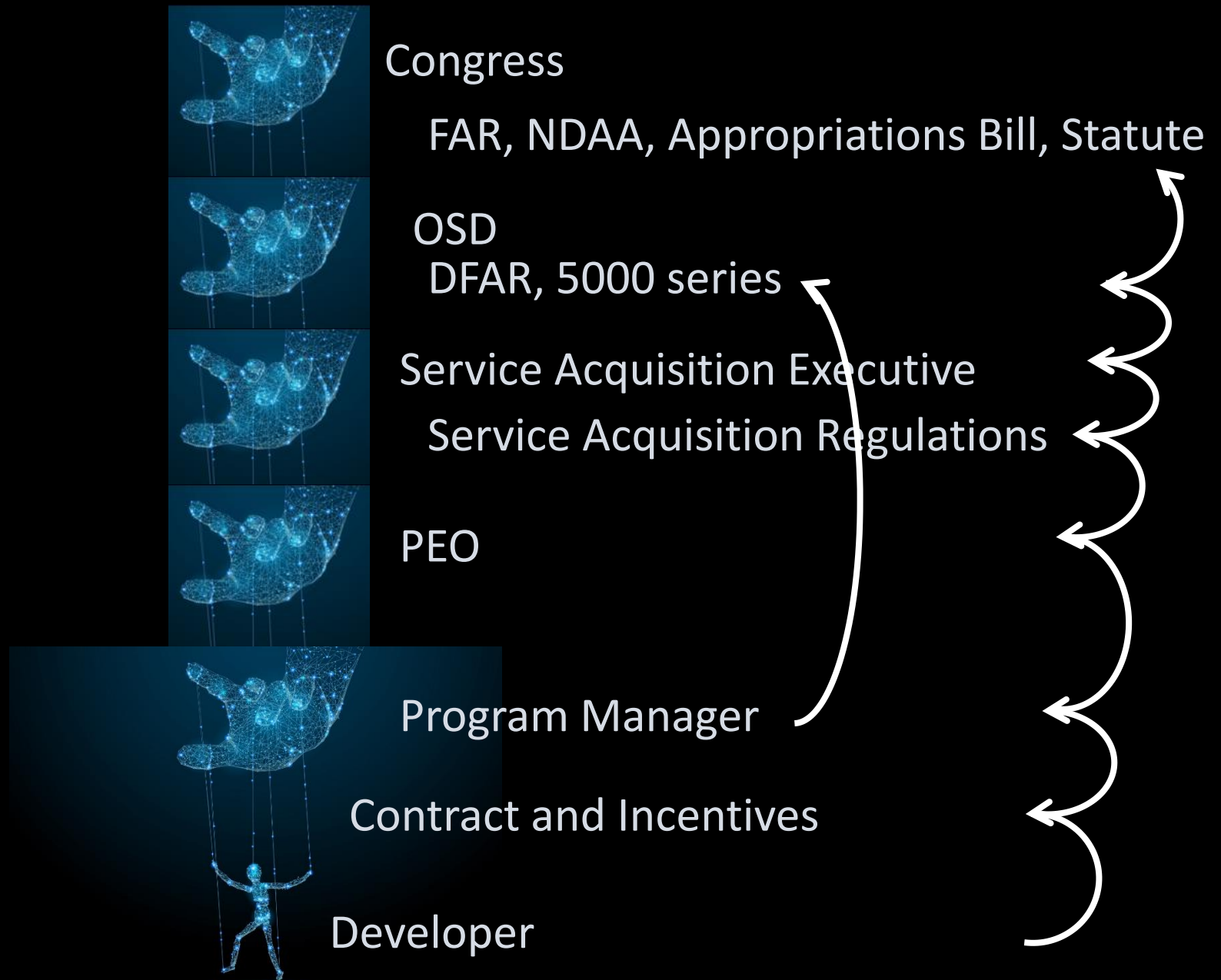


Program Manager

Contract and Incentives

Developer

And the Feedback Loops?



Process

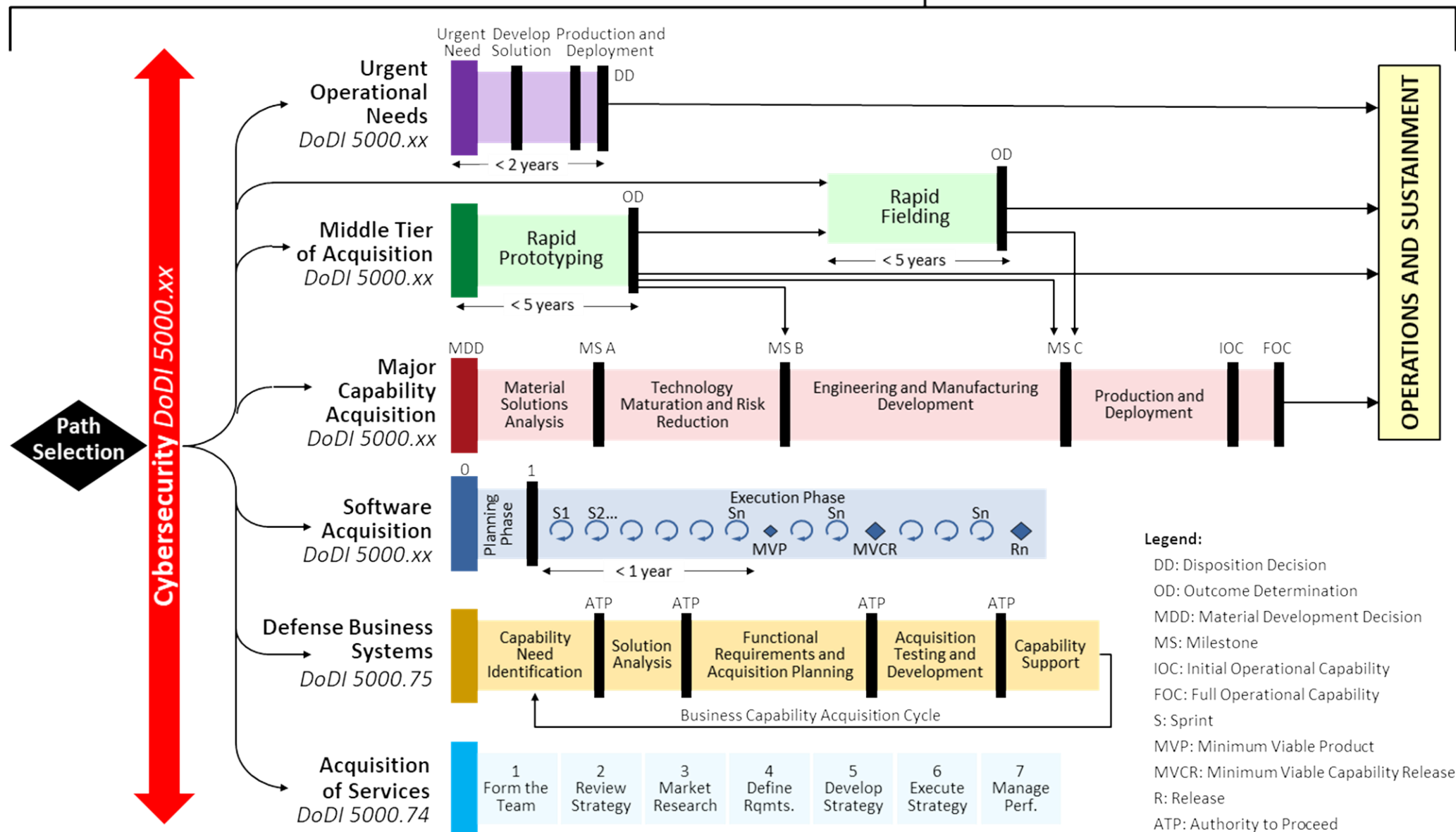
Adaptive Acquisition Framework

Tenets of the Defense Acquisition System

1. Simplify Acquisition Policy
2. Tailor Acquisition Approaches
3. Empower Program Managers
4. Data Driven Analysis
5. Active Risk Management
6. Emphasize Sustainment

DoDD 5000.01: The Defense Acquisition System

DoDI 5000.02: Operation of the Adaptive Acquisition Framework



DoD 5000 Series Policy Development Process

19/1540 Jul 19

Revised DoD Instruction 5000.02, Operation of the Adaptive Acquisition Framework

Current DoDI 5000.02

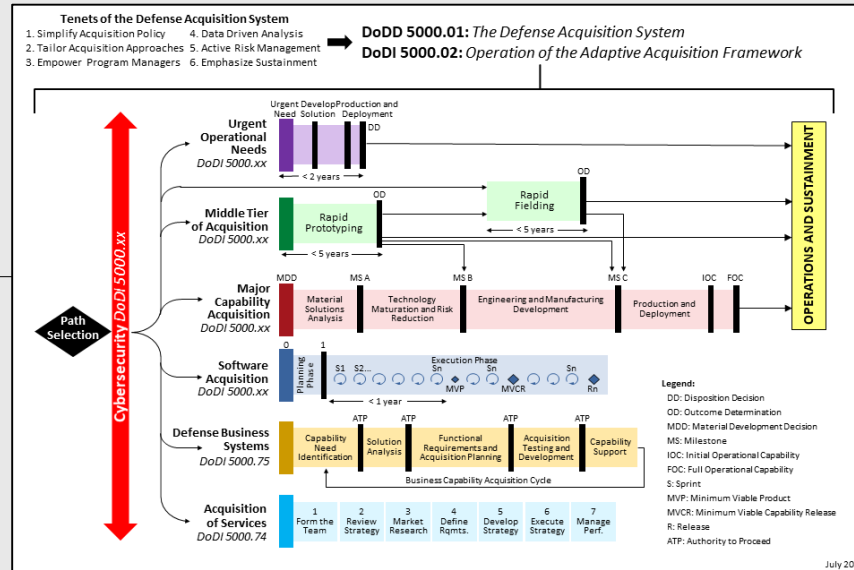
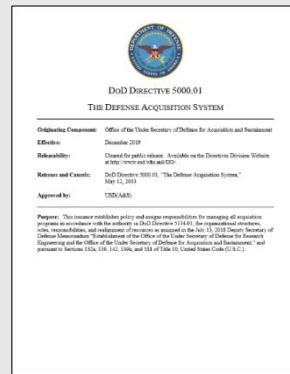
❖ CORE A&S ACQUISITION POLICY

- Policy
- Responsibilities
- Procedures
- Decision Points and Phases

❖ FUNCTIONAL ENCLOSURES

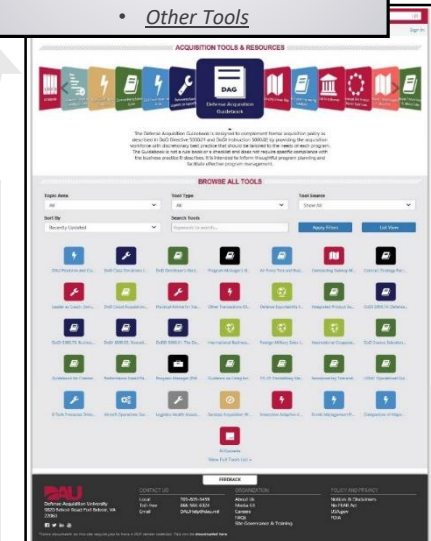
Acquisition Categories and Compliance Requirements	A&S
Program Management	A&S
Systems Engineering	R&E
Developmental T&E	R&E
Operational & Live Fire T&E	DOT&E
Life-Cycle Sustainment	A&S
Human Systems Integration	P&R
Affordability Analysis and Investment Constraints	A&S
Analysis of Alternatives	CAPE
Cost Estimating and Reporting	CAPE
Information Technology	CIO
Urgent Capability Acquisition	JRAC
Cybersecurity	R&E

Revised DoD Directive 5000.01

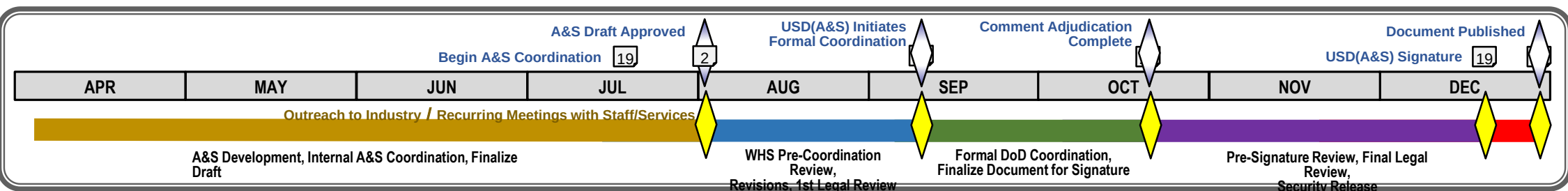
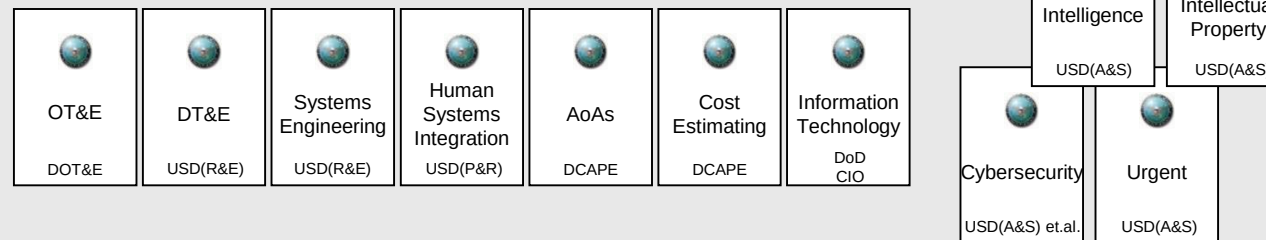


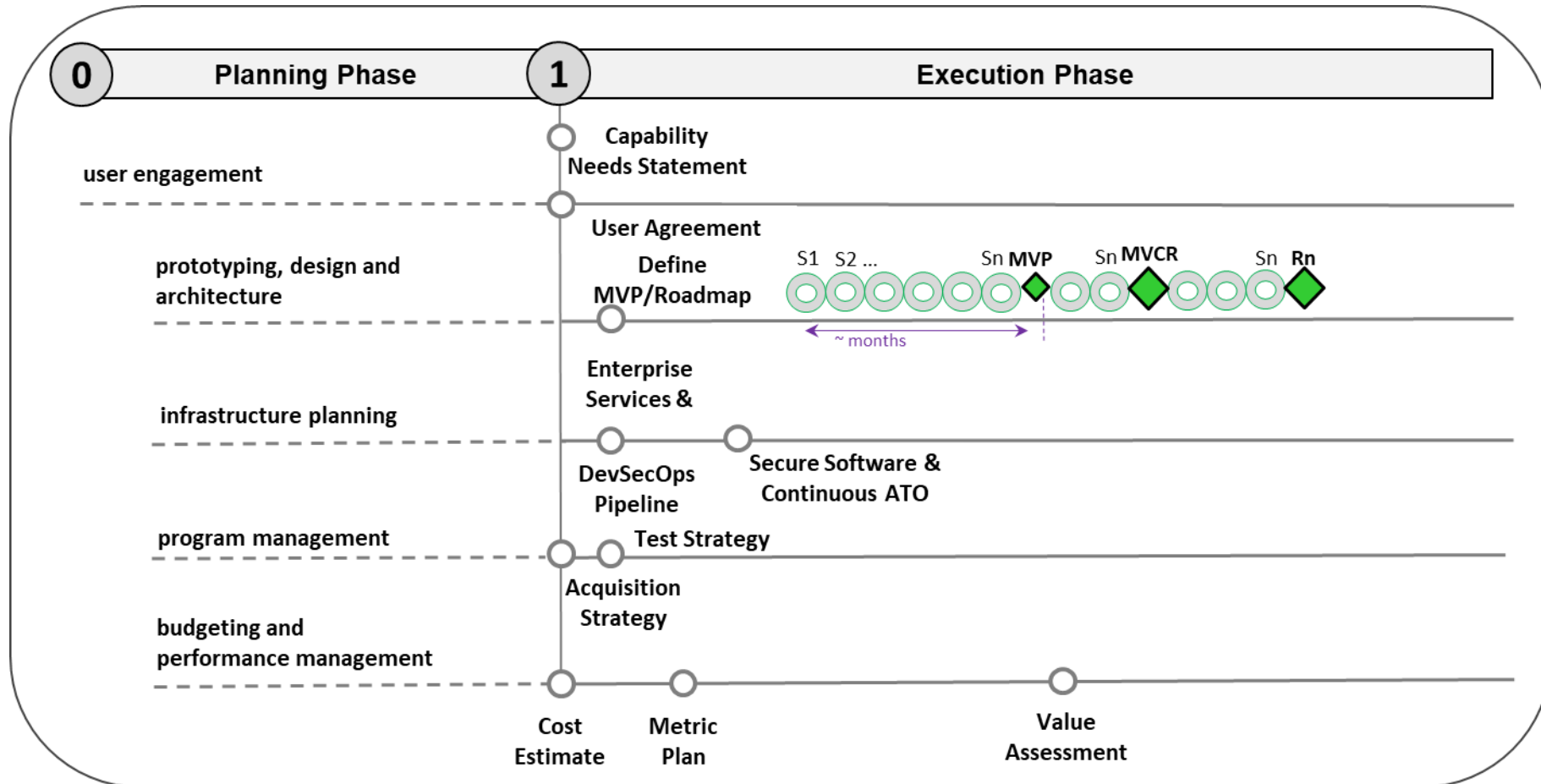
DAU Website

- [DoD Directive 5000.01](#)
- [DoD Instruction 5000.02](#)
- [DoD Instructions 5000.xx, \(ea. Pathway\)](#)
 - [Functional Policy Documents](#)
 - [Tables \(Milestone Documentation Identification Tool\)](#)
- [Defense Acquisition Guidebook](#)
- [Other Tools](#)

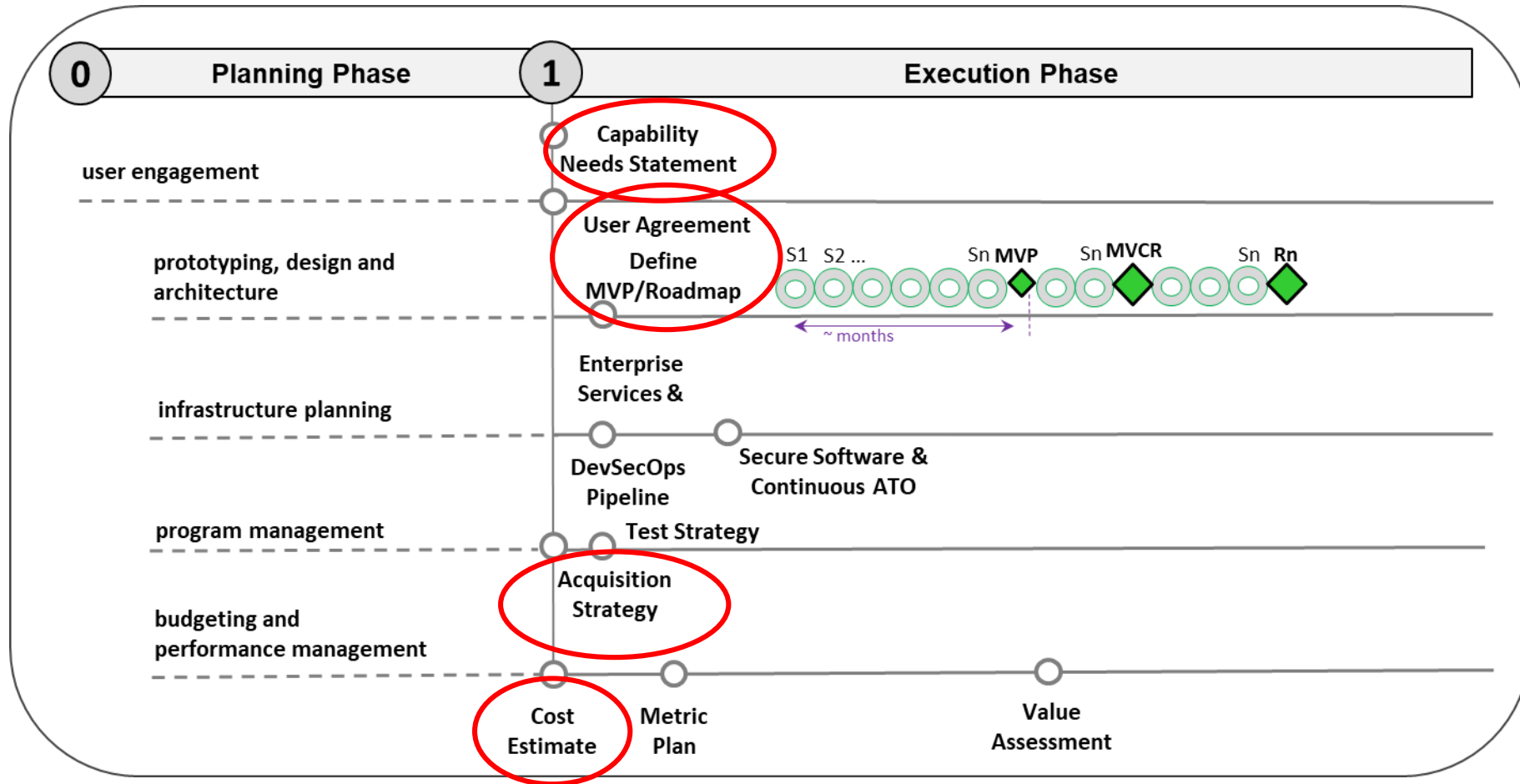


Separately Published Functional Policies

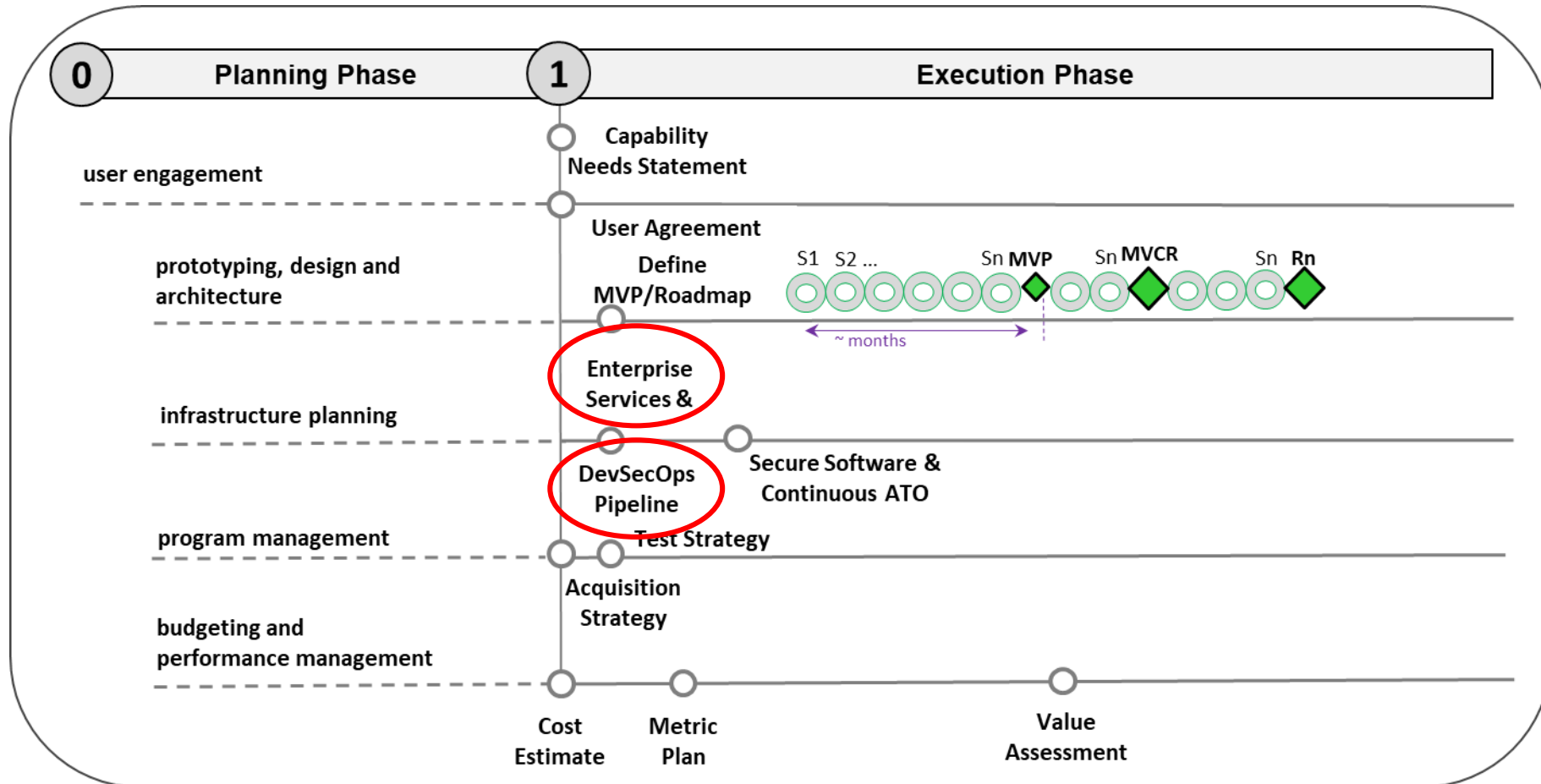




Software Acquisition Pathway – draft/pre-decisional

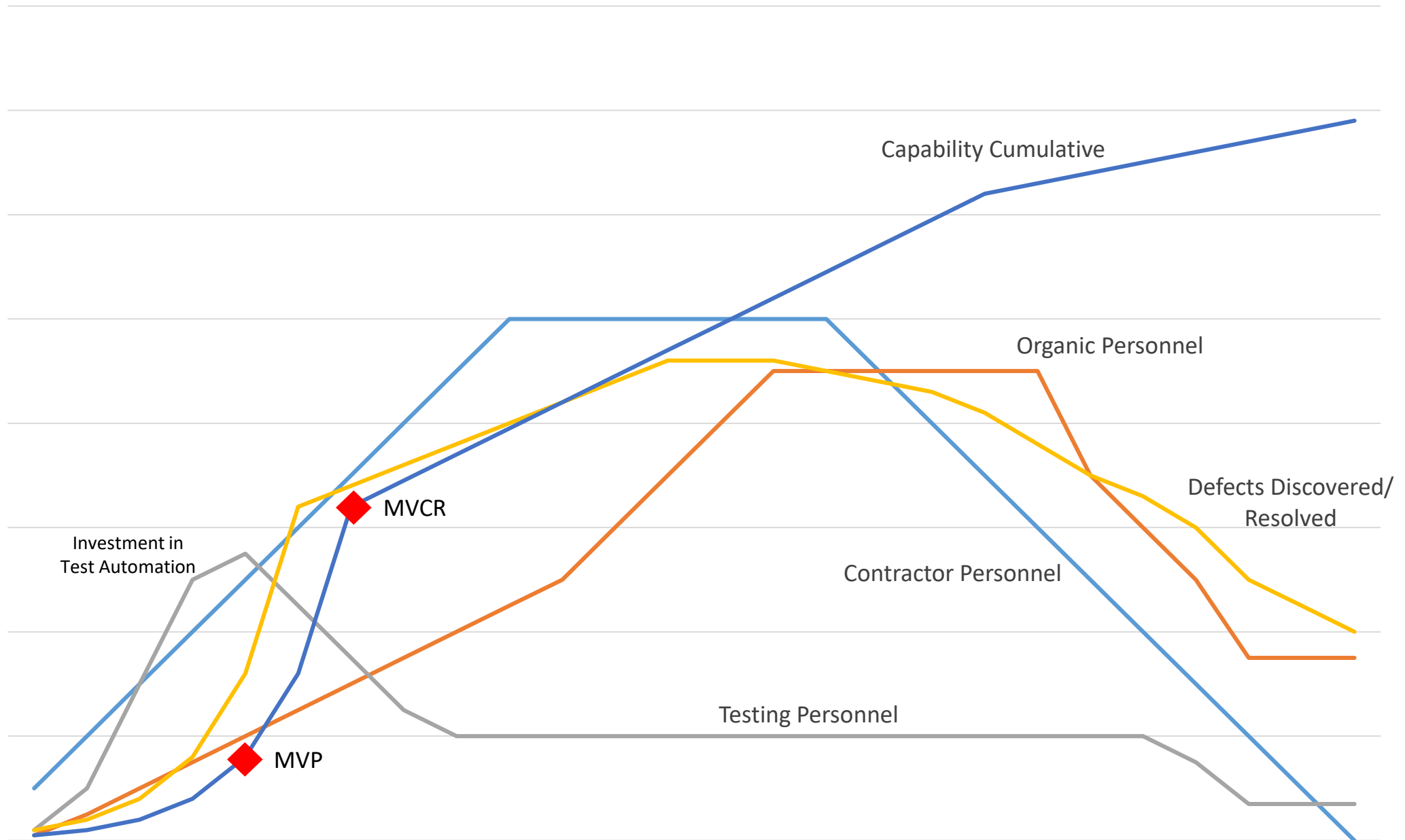


Software Acquisition Pathway – draft/pre-decisional



Software Acquisition Pathway – draft/pre-decisional

Notional Software Development Effort (contractor and organic), Defects, and Capabilities



Engagement and feedback

- Engagement

- May – US Chamber of Commerce
- May - 16th Annual Acquisition Research Symposium
- July - feedback session hosted by NDIA, AIA event, quarterly industry association round table
- August – PEO forum, SW Acq Pathway wargame, PSC

- Feedback

- Need to better describe linkage to system's engineering process
- How does this map to embedded software?
- Where does developmental and operational testing fit in?
- This will be hard to estimate cost

Software Appropriation

- Comptroller and A&S legislative proposal
- New Budget Activity (BA 8) Software & Digital Technology Pilot Programs
 - Within existing RDT&E appropriation
 - Established for each service and defense wide
 - 2 year funding
 - Available for select pilot programs in FY-21 if approved
- Pilot programs will use BA 8 as one source of funding for full lifecycle
 - Development,
 - Procurement,
 - Deployment,
 - Assurance,
 - Modifications, and
 - Continuous improvement
- A&S evaluating 12 nominated pilot programs now



Requirements

Fix schedule and cost

Allow/encourage Scope (aka Requirements) to evolve and change

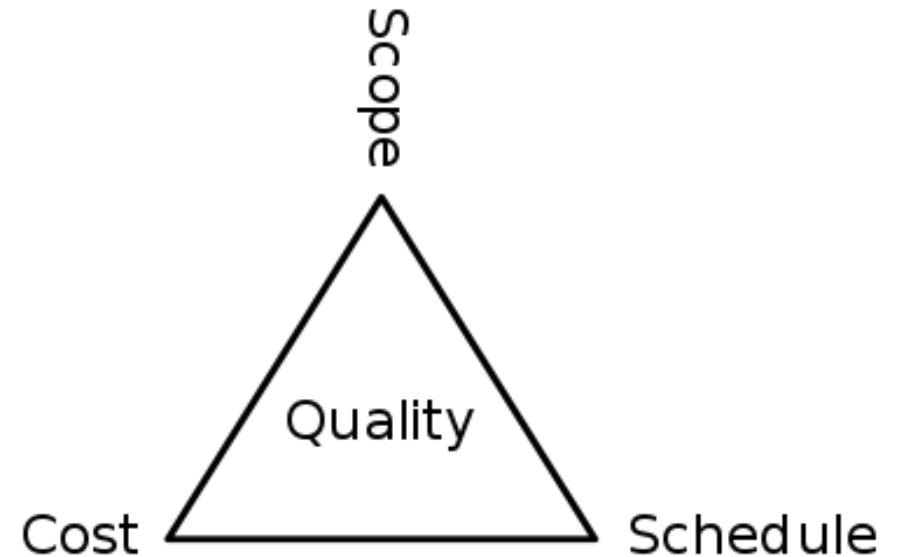
Require frequent deliveries

Evaluate delivered scope/capability and quality via metrics

Start small with minimal risk

Attack highest ROI MVP first

Determine if value delivered justifies continuing



Questions and Feedback