Recommendations for Maximizing Digital Thread Return on Investment

NDIA 27th Annual Systems & Mission Engineering Conference

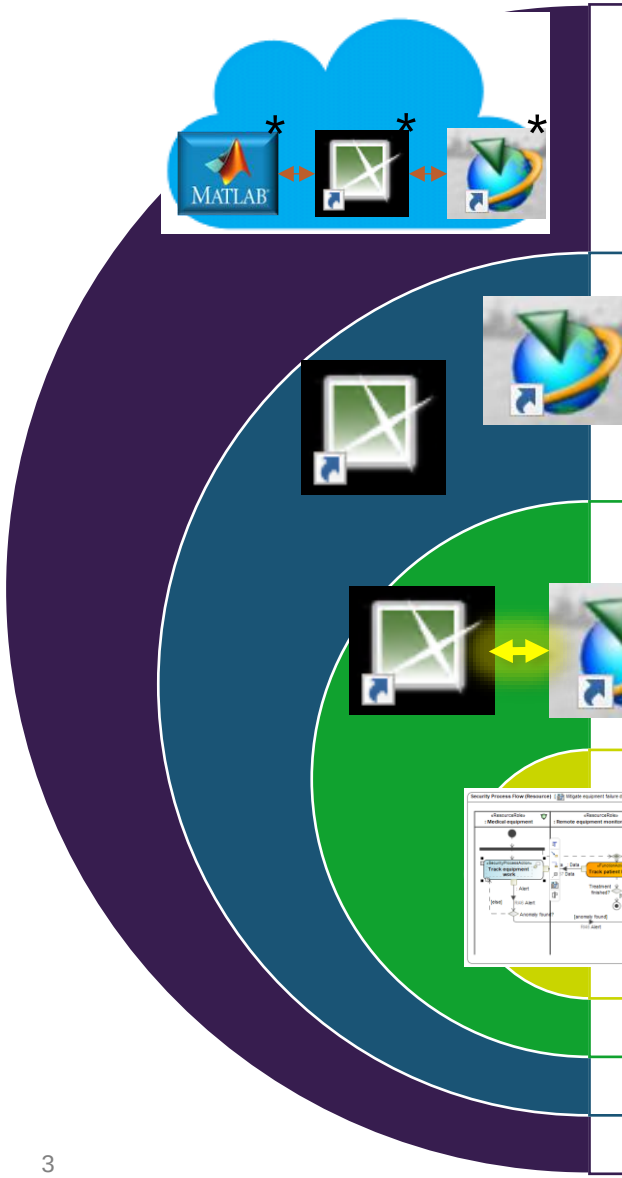
Natalie Nakamura
Northrop Grumman Aeronautics Sector
Sr Manager, Systems Engineering
29 October 2024

NORTHROP GRUMMAN

Agenda

- Nomenclature
- Problem Statement & Challenges
- Investment Considerations for New Thread
- How to Calculate Return
- Example Use Cases
- Conclusion & Recommendations

Nomenclature



Digital Ecosystem

- Access-controlled, enterprise network
- Secure
- Operating system agnostic
- Can span multiple security levels

Applications / Tools

- MS Office
- MS Teams or other Collab Tools
- Software (Eng, Mfg, Procurement)
- Executables

Digital Threads

- Connection between two applications
- Can be manual or automatic
- Can be API, custom plug-in, script

Program Data

- Engineering baselines (i.e., allocated)
- Models
- Datasets
- Metrics

*Cameo property of Dassault;
Teamcenter property of Siemens;
Matlab property of MathWorks.

NORTHROP GRUMMAN

Problem Statement & Challenges

Like a weapon system, an integrated digital engineering (DE) ecosystem requires resources to develop, implement, and manage automated interfaces.

Challenges:

Technology Maturity

- APIs
- Docker/K8
- Cloud compatibility
- Forwards/ backwards compatibility of software versions

Regulation & Standards

- DoDI 5000.97 ♥
- No Gov Ref Arch
- No DE MIL-STDs
- No regulatory agency

Talent

- DE architects need both program lifecycle and IT experience (unicorns)
- Right-sizing DE requirements is extremely difficult

NORTHROP GRUMMAN

Investment Considerations for New Thread

Customer

- Scope of work (new platform, prototype, retrofit, component)
- **Certifications** (Cybersecurity, Airworthiness, Safety)
- DE requirements (performance, storage, accessibility)
- Data rights assertions

Program

- **Size** (contract value, number of staff, number of suppliers)
- Schedule (accelerated or traditional)
- Current phase
- Security levels

Digital Thread

- Baseline data
- **Data exchange rates** (daily, weekly, monthly)
- Complexity of dataset

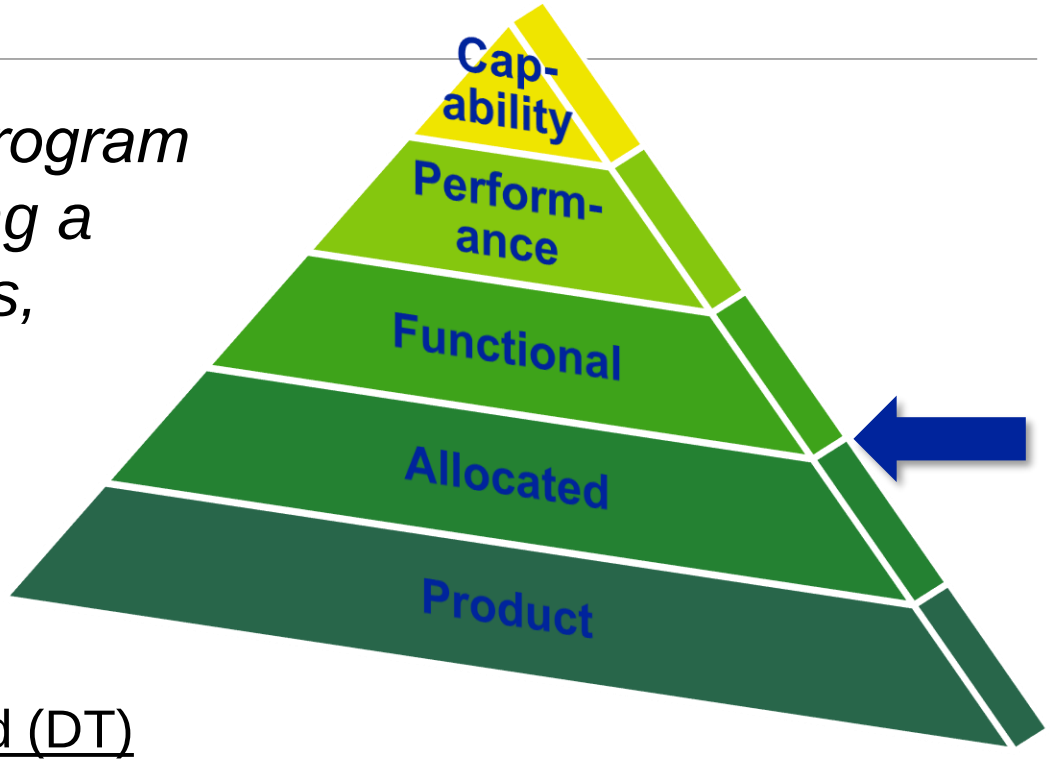
Enterprise (Enabler)

- Leverage DE investments
  - Tailoring may be required
  - Maturity of tools
- IT talent pool & availability
- License pools

Certifications, Program Size, and Data Exchange Rates are Key Drivers

How to Calculate Return

You're a new PM. You have a strong bench of program performers and support staff. You are considering a digital thread between two engineering baselines, Functional and Allocated.



$$R = \frac{V_f - V_i}{V_i}$$

R = return
V_f = final value, including dividends and interest
V_i = initial value

Option 1:
Do nothing
- 1 sad intern ($)

Option 2:
Develop automated digital thread (DT)
- *Vf* = benefit of developing thread ($ - $$$)
  - Does not include: benefits to other programs
- *Vi* = cost to develop thread ($$$)
  - Includes: IT, program engineering, testing, s/w version updates

$$\boldsymbol{R} = \frac{\left(\left(\boldsymbol{\#\ of\ data\ exchanges}, f(program)\right) \times \left(\boldsymbol{level\ of\ rigor}, f(certifications)\right)\right) - \boldsymbol{DT\ Dev\ Cost}}{\boldsymbol{DT\ Dev\ Cost}}$$

NORTHROP GRUMMAN

Example Use Cases

$$R = \frac{(\#\ of\ data\ exchanges \times level\ of\ rigor) - DT\ Dev\ Cost}{DT\ Dev\ Cost}$$

Use Case 1: New system
- New capability development
- Many requirements
- Franchise (many variants and customers)
- Many suppliers
- Traditional acquisition phases (TMRR/EMD/LRIP/FRP)
- Big staff
- Many new certifications

$$R = \frac{(\$\$\$ \times \$\$\$) - \$\$\$}{\$\$\$}$$

$$= HIGH\ (\$\$ - \$\$\$)$$

Use Case 2: Flying Test Bed
- New capability integration
- Some requirements
- Integration of new development and COTS components
- Commercial derivative
- Accelerated schedule
- Hybrid certs, Military + FAA

$$R = \frac{(\$\$ \times \$\$) - \$\$\$}{\$\$\$}$$

$$= MED/LOW\ (\$)$$

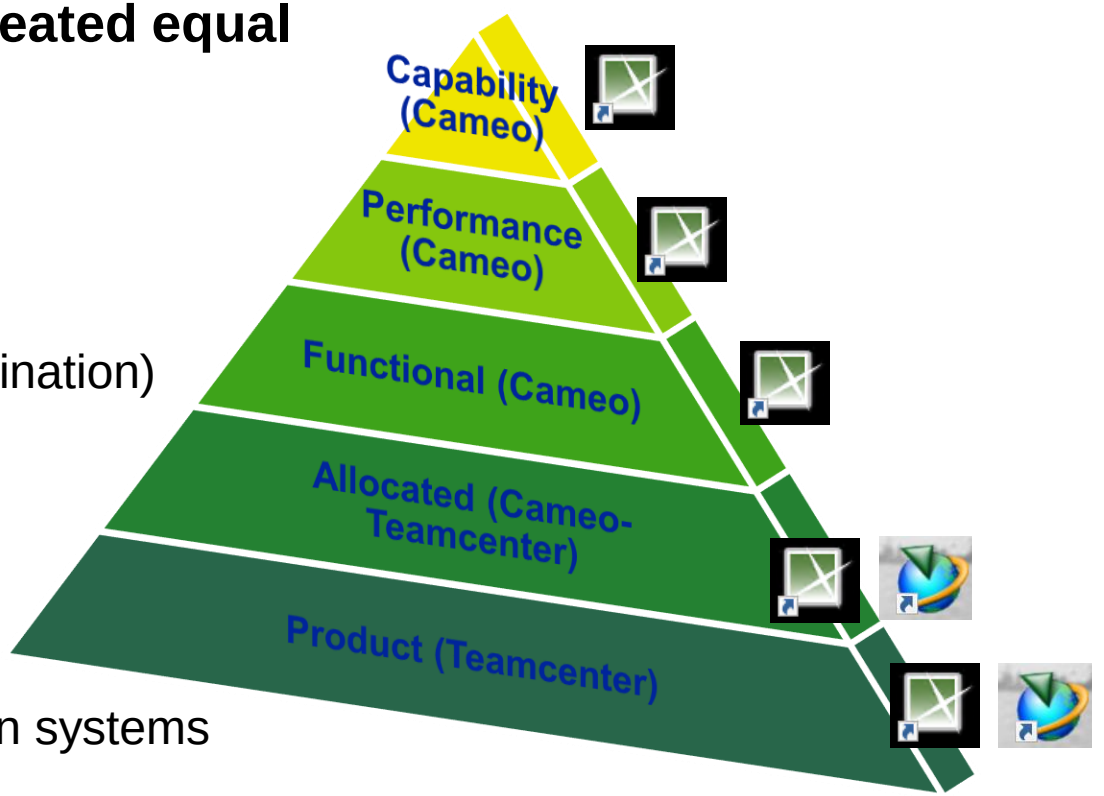
Use Case 3: Retrofit of A/C
- Existing capability upgraded
- New requirements added to existing requirements
- Mostly COTS components/ suppliers
- Legacy program office
- Legacy tools, drawings
- Modified certs

$$R = \frac{(\$\$ \times \$) - \$\$\$}{\$\$\$}$$

$$= LOW\ (-\$)$$

Conclusion & Recommendations

- As a new PM, now you know that **programs are not created equal for high digital thread ROI**
  - Program SOW compliance comes first
  - Enterprise perspective may be different
- **Best Practices for ANY Program**
  - Reduce application sources of truth (culture, training, coordination)
  - Rigorize what data goes where (data governance)
  - Configuration manage only what is required
- **Help Needed (USG)**
  - DE standards and enforcement
    - Vendor lock happens with DE suppliers as often as mission systems suppliers
    - DoDI 5000.97 and USAF Digital Building Code are goodness
    - Where's our DE Gov Ref Architecture (GRA)?
  - Do not levy specific s/w versions
  - Culture change is needed—everyone must participate in the digital environment



*Cameo owned by NoMagic/Dassault
Teamcenter owned by Siemens