

# **Systems' Perspectives for AI Acceleration in Large Enterprises and Government Agencies**

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# Agenda

- Criticality of Systems Engineering in AI
- Systems Engineering Lifecycle
- Deriving AI Enabled themes from current state analysis
- Creating Architectural Artifacts
- Assurance and Trustworthiness through Systems Engineering
- Conclusion

# Criticality of Systems Engineering in AI

- To scale AI, agencies and enterprises require understanding of needs and capabilities, and common themes from these needs and capabilities
- Awareness of System Dependence and sequencing can be very helpful to accelerate AI
- Systems Engineering plays a critical role towards Assured and Trustworthy AI, AI that is ethical, compliant with regulations, secure, and trusted by the users
- Systems engineering is required to properly handle the development and deployment of AI and AI-enabled applications through the system engineering supported agile cycle and continues improvement and deployment

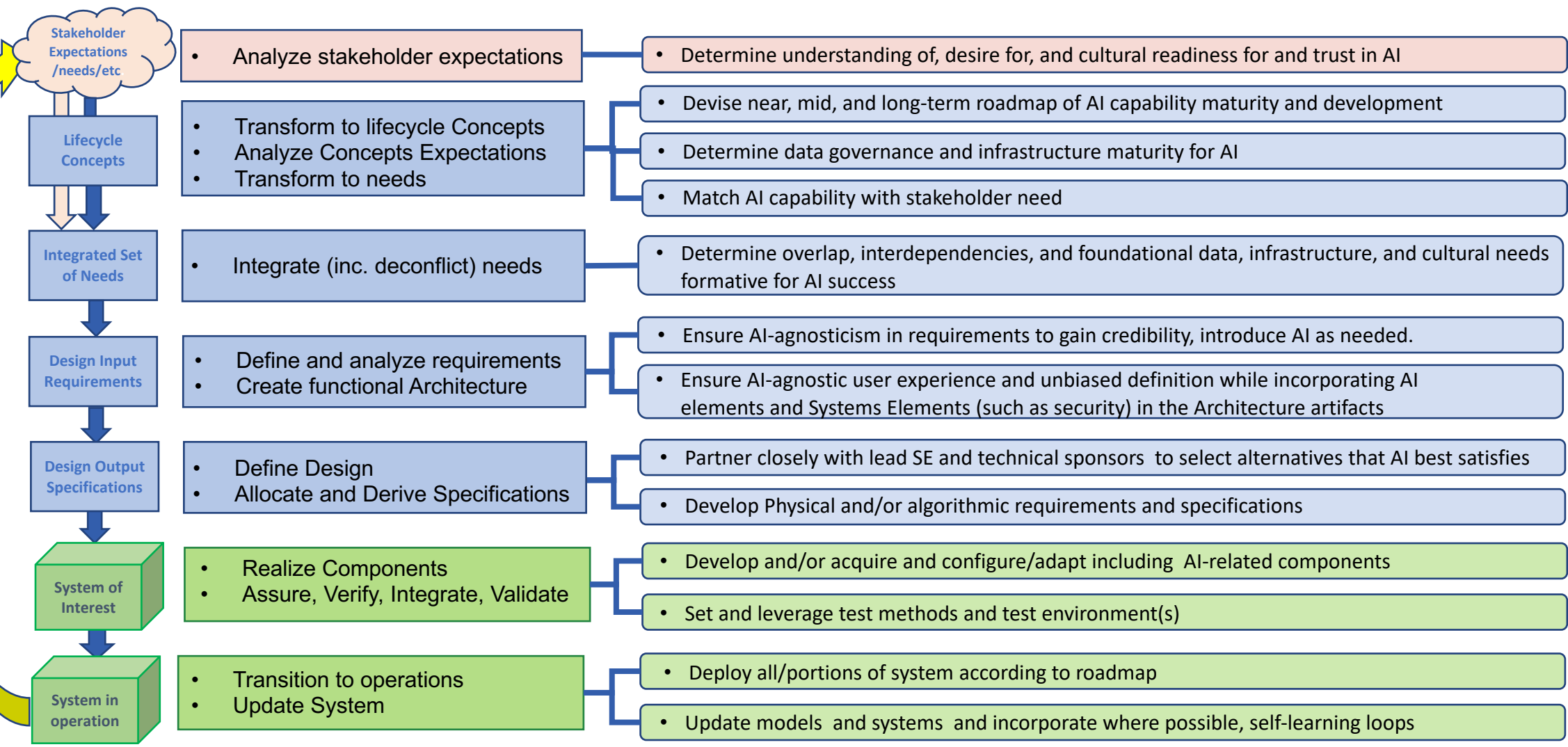


# SE Lifecycle

## Lifecycle

## AI Enablement Considerations at All Steps

AGILE & ITERATIVE



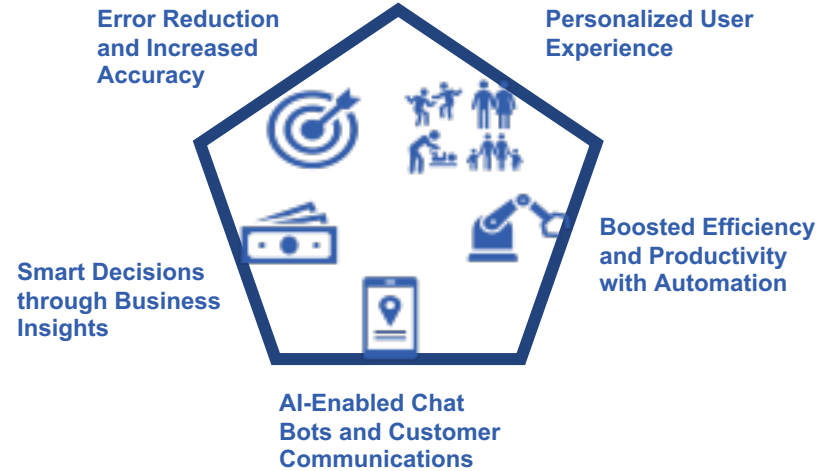
SE is important for infrastructure, platform environment, and enterprise development of AI and AI apps.

# Deriving AI themes from current state analysis



## Summarized Business Needs from Engagement Sessions

Cross-stakeholder needs are understood. Potential technology capabilities needed to realize needs are identified.



## Synthesized “AI Enabled Themes” Across the Organization

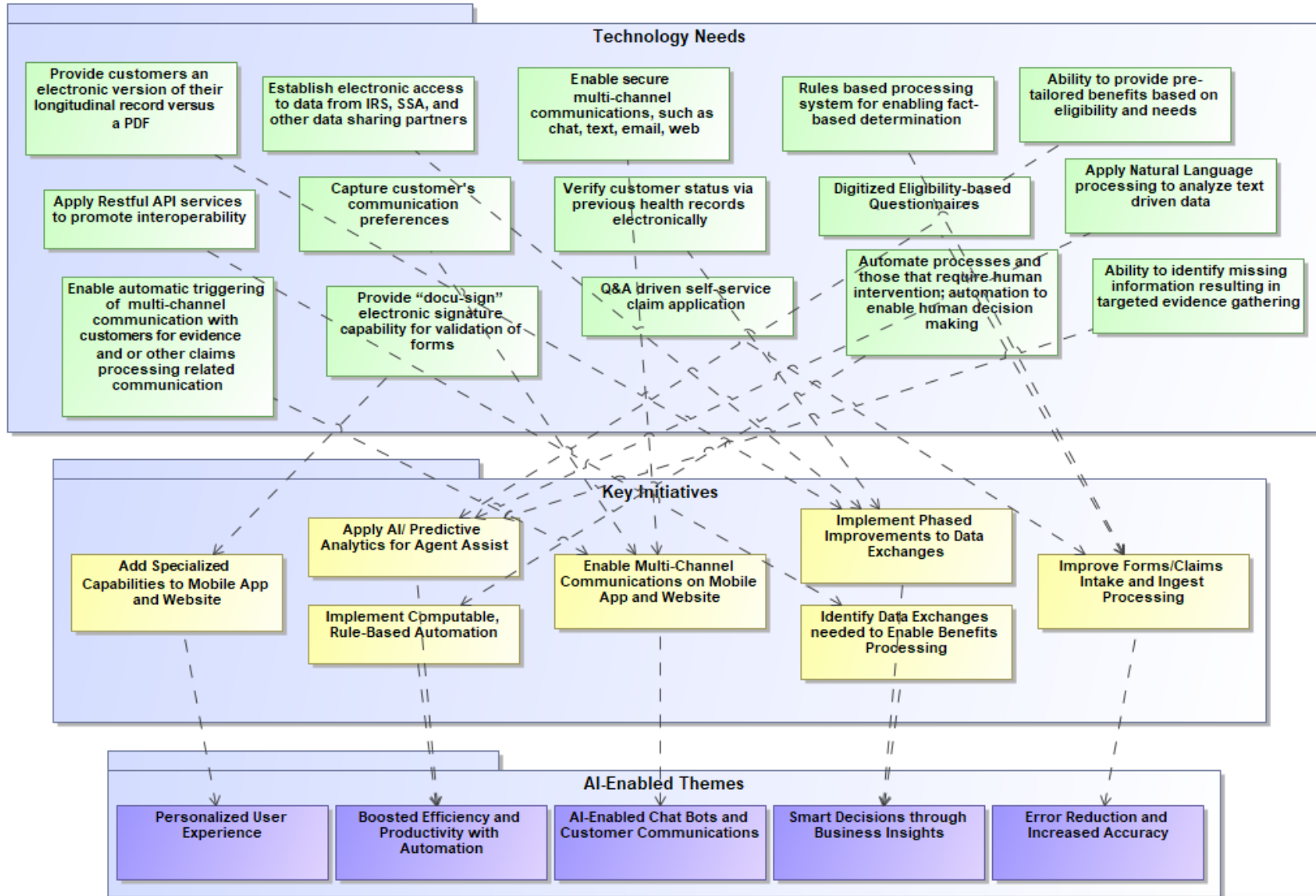
Common themes are synthesized from the needs and potential technology capabilities with Traceability to stakeholders.



## Comprised Into Initiatives and Fiscal Year Sequencing

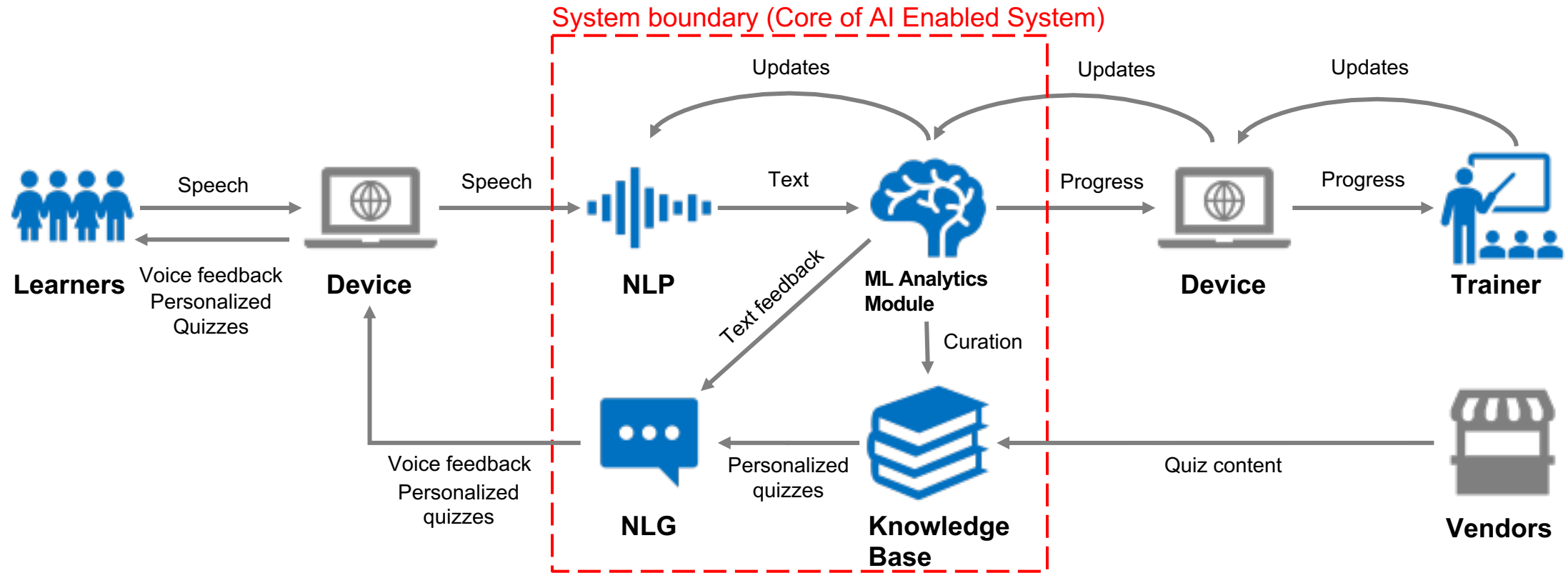
Stakeholder business and technology needs are traced to the themes and sequenced by dependencies between initiatives.

# AI Enabled Themes



- Model-Based Systems Engineering (MBSE) enables the synthesis of AI-driven themes from complex data and relationships.
- Five example themes, interdependent for success, are executed through various projects across business lines.
- Organized approach with a single source of truth is essential for managing complexity.
- AI initiatives should be prioritized based upon:
  - Potential impact
  - Feasibility
  - Alignment with goals
  - ROI
  - Stakeholder buy-in

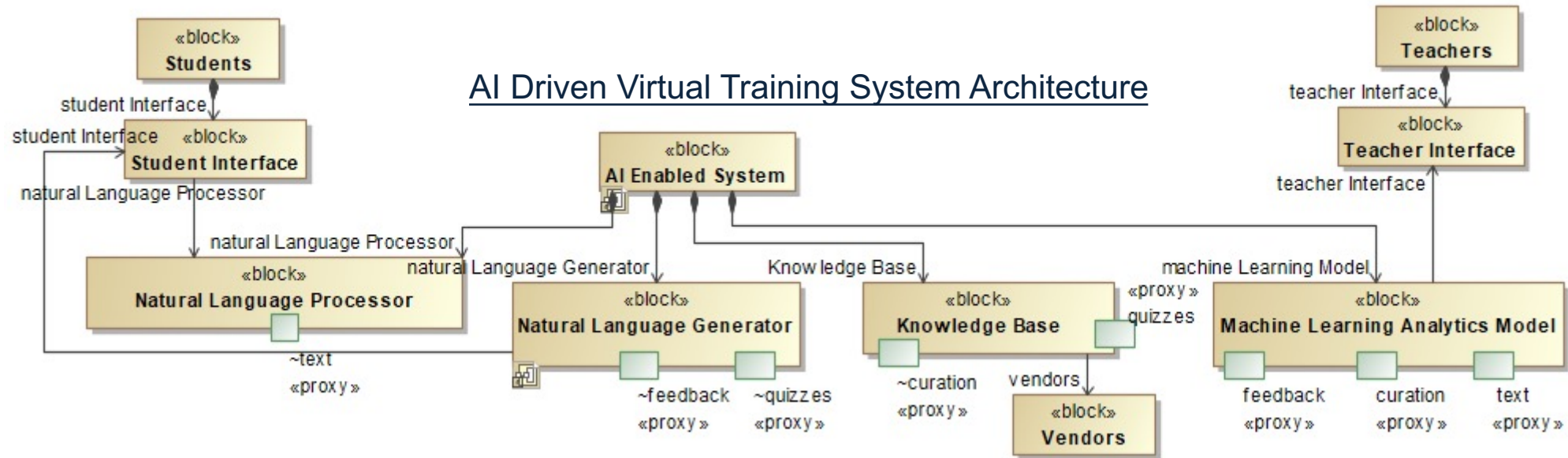
# Architecture to Enable AI



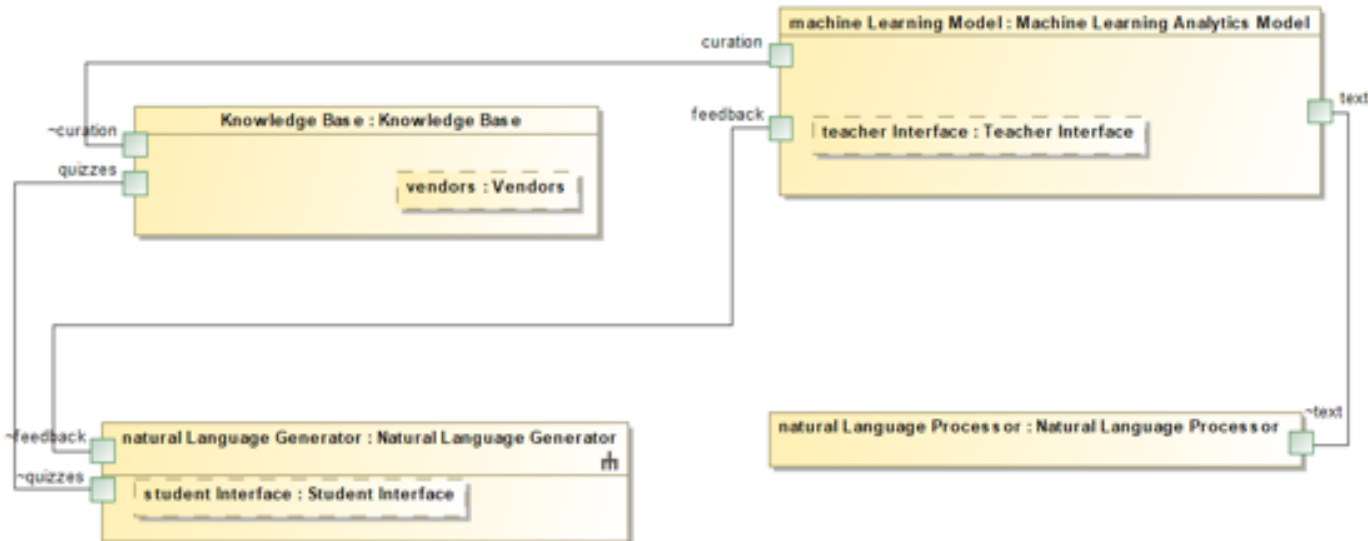
## AI Driven Virtual Training System Architecture

# Architecture to Enable AI

Level 1:



Level 2:



## Level 1 Block Definition Diagram:

Shows system-level interactions between AI-enabled system components and external interfaces

## Level 2 Internal Block Diagram:

Details information flow between AI-enabled system components and highlights port connection schemes.



# Assurance and Trustworthiness through Systems Engineering

- To Accelerate AI, it must be accepted culturally into an enterprise
- This can be gained by focusing on the Assurance and Trustworthiness of AI
- Overall, people will be more willing to accept AI if they can perceive it as a benefit to their job
- To be trusted it will require systematic testing with the complexity and system-to system integration, system and human user interaction, all these require robust and agile system engineering to automatically test against acceptance criteria.



## **Trialability**

Potential users have a chance to experience the product



## **Ethics**

How the product was created, the ethics and governance that it follows to mitigate bias



## **Image/Perception**

How the product is perceived, is there to help people do their job, or take their job?



## **Representation**

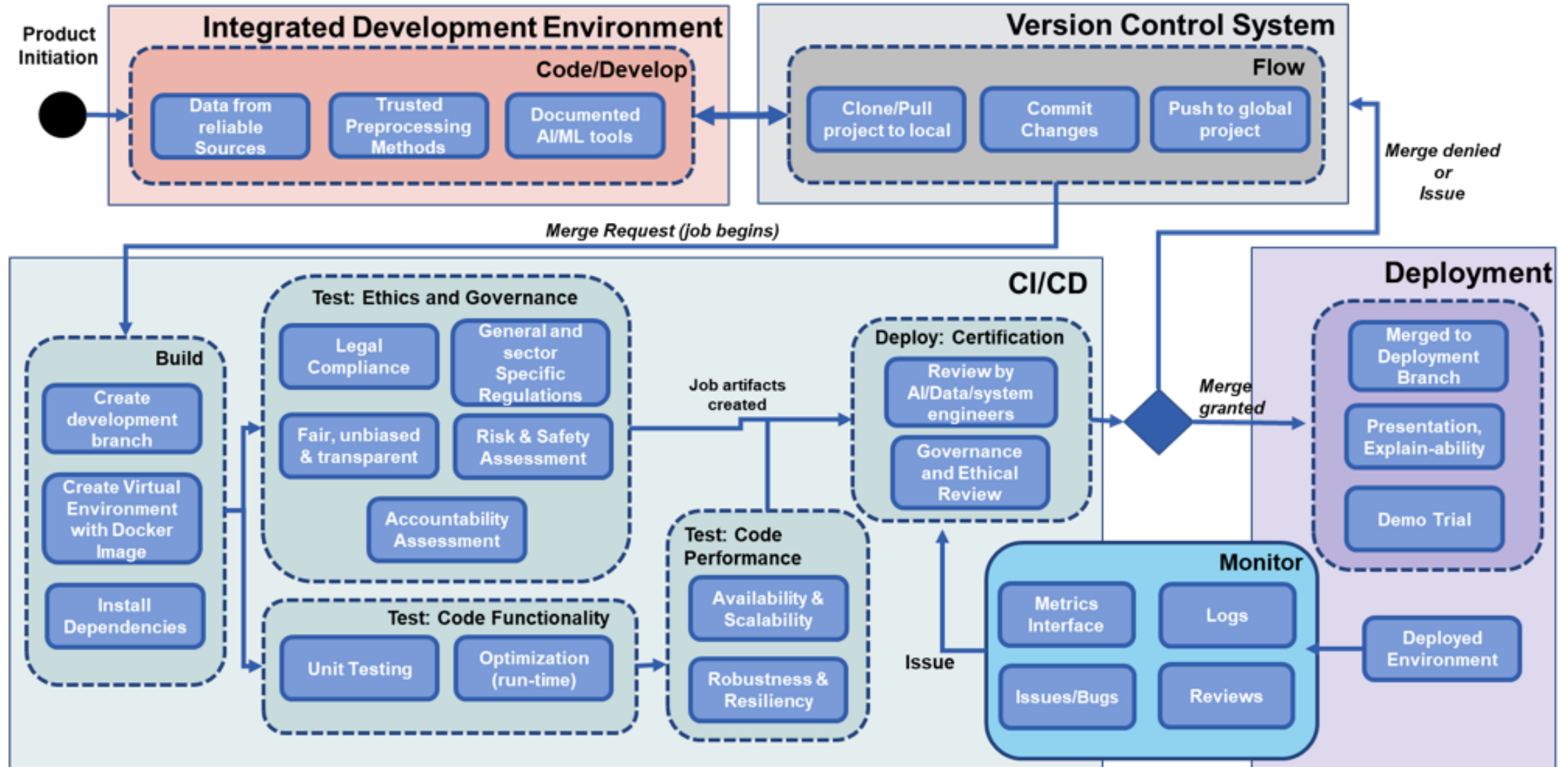
How the product is represented, whether that be a machine, audio device, etc.



## **Performance**

How the product performs, is it reliable? Or is it another roadblock

# Development Pipeline



# Enabling CI/CD using MBSE

- Systems approach to create a high-level overview of the process
- Works as a functional blueprint
  - Diagrams can be nested
- Executable model to see if the process breaks down
- Able to pinpoint system fallacies via simulation
- Ability to trace/implement requirements with diagrams
- MBSE allows for the agile process to be fully utilized
- Without MBSE, requirements and design may not have a defined relationships
- Gitlab CI/CD pipeline implementation. Showing the full process of automating AI Assurance.
- The pipeline creates jobs and assigns them to specific SMEs for approval before Agile deployment.



## Version Control/Deployment



# Tangible Pipeline

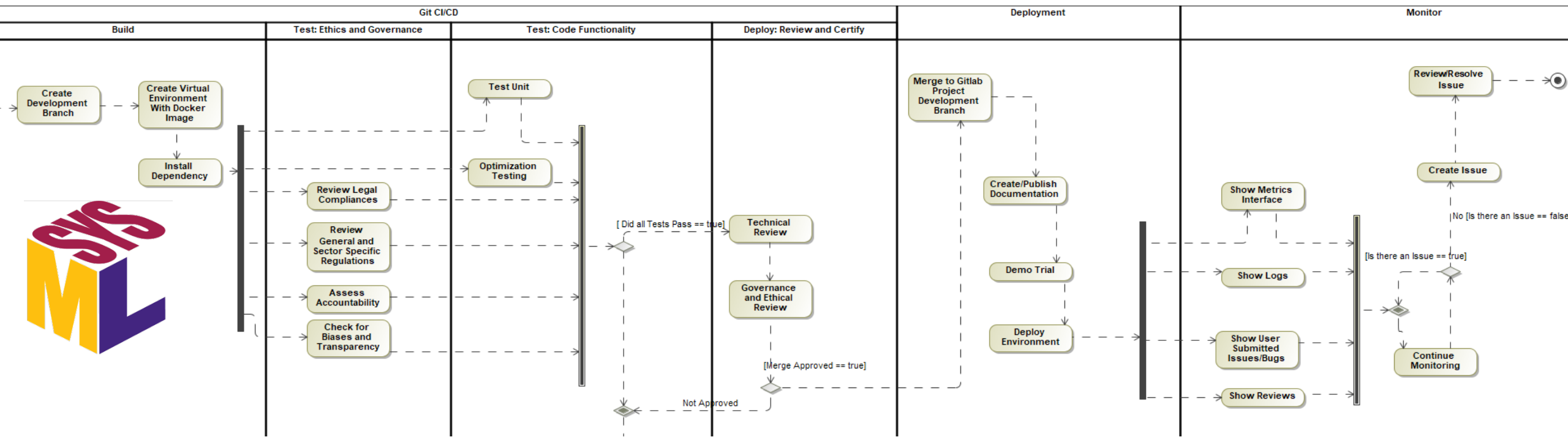
yml pipeline

Human-readable  
data-  
serialization  
language that  
allows to  
configure  
pipelines as  
code

```
1 stages:
2   - build
3   - test
4   - approve
5   - deploy
6
7 image: python:latest
8
9 variables:
10  PSP_CACHE_DIR: "${CI_PROJECT_DIR}/cache/ydp"
11  USERNAME: "marshall"
12  TEST: working
13
14 cache:
15   - cache/ydp
16   - venv/
17
18 paths:
19   - .cache/ydp
20   - venv/
21
22 build:
23   stage: build
24   tags: [python, shell]
25   script:
26     - python --version # for debugging
27     - pip install virtualenv
28     - virtualenv venv
29     - venv/scripts/activate
30     - pip install -r use_case/requirements.txt
31     - pip install tox
32     # pip install -r use_case/READMEStatement.txt
33     - pip install tox
34     - echo "Hello world"
35     # source venv/bin/activate
36
37 unit_testing:
38   stage: test
39   tags: [python, shell]
40   script:
41     - echo "performing unit tests"
42
43 Legal_Compilance_and_Sector_Regulations:
44   stage: test
45   needs: []
46   tags: [python, shell]
47   script:
48     - cat use_case/MissionStatement.txt
49     - echo "Legal Compliance and General Regulations testing"
50     - echo "GUIDEDWARD, SPASSOBS, STOS"
51
52 artifacts:
53   paths:
54     - use_case/READMEStatement.txt
55
56 Transparency:
57   stage: test
58   needs: []
59   tags: [python, shell]
60   script:
61     - python -m use_case/Transparency
62     - echo "Transparency testing"
63
64 artifacts:
65   paths:
66     - pspg.txt
67
68 Fairness_Bias:
69   stage: test
70   needs: []
71   tags: [python, shell]
72   script:
73     - python -m use_case/Fairness_Bias
74     - echo "Fairness Bias Transparency testing"
75
76 artifacts:
77   paths:
78     - README.txt
79
80 Risk_Safety_Assessment:
81   stage: test
82   needs: []
83   tags: [python, shell]
84   script:
85     - echo "Risk and Safety testing"
86
87 Approve_Legal:
88   stage: approve
89   tags: [python, shell]
90   script:
91     - echo "waiting approval"
92     - if: $CI_PIPELINE_SOURCE == "push"
93       then: manual
94     else: manual
95
96 Approve_Safety:
97   stage: approve
98   tags: [python, shell]
99   script:
100    - echo "waiting approval"
101    - echo "waiting approval"
102    when: manual
103    allow_failure: false
104
105 Approve_Function:
106   stage: approve
107   tags: [python, shell]
108   script:
109     - echo "waiting approval"
110     - cat use_case/READMEStatement.txt
111     when: manual
112     allow_failure: false
113     environment:
114       name: test
115       url: https://new-gitlab-environment.com
116
117 Approve_Legal_Function:
118   stage: approve
119   tags: [python, shell]
120   script:
121     - echo "waiting approval"
122     - cat use_case/READMEStatement.txt
123     when: manual
124     allow_failure: false
125     environment:
126       name: test_2
127       url: https://new-gitlab-environment.com
128
129 Deploy:
130   stage: deploy
131   tags: [python, shell]
```



GitLab  
Pipeline



# Conclusion

- Systems Engineering is critical in Enterprise-wide AI Acceleration above and beyond individual use cases
- The work presents how to use systems engineering lifecycle to accelerate AI
- Assurance and trustworthiness can be ensured through a continuous integration and continuous deployment pipeline enabled by Model Based Systems Engineering

# Questions

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