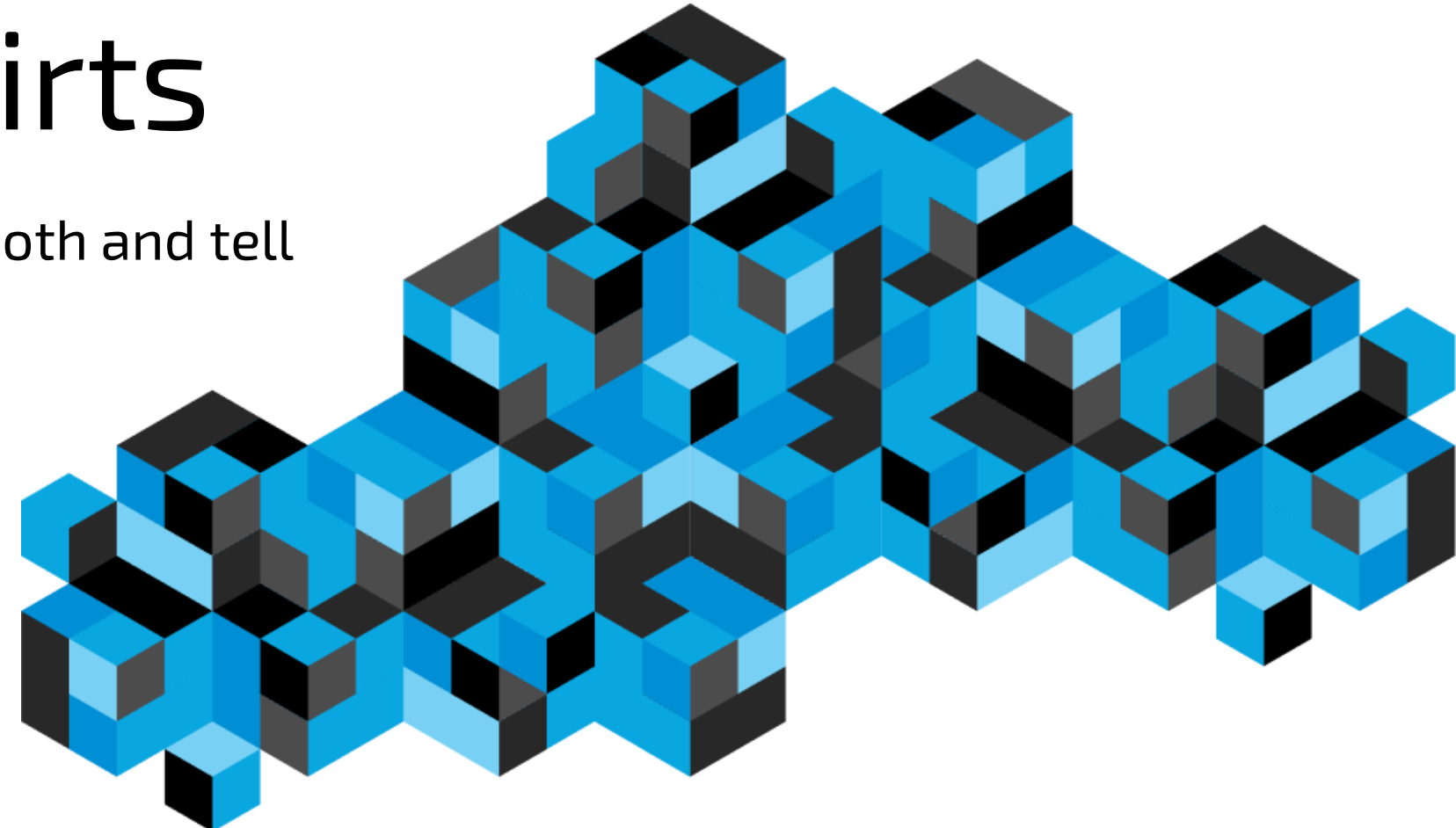
Digital Twins in Test And Measurement

How the Testeract TestPoint framework works with digital engineering

Testeract

Free TShirts

Go to the Testeract booth and tell them I sent you!



MEET THE PRESENTERS

ABOUT US

PRESIDENT/FOUNDER

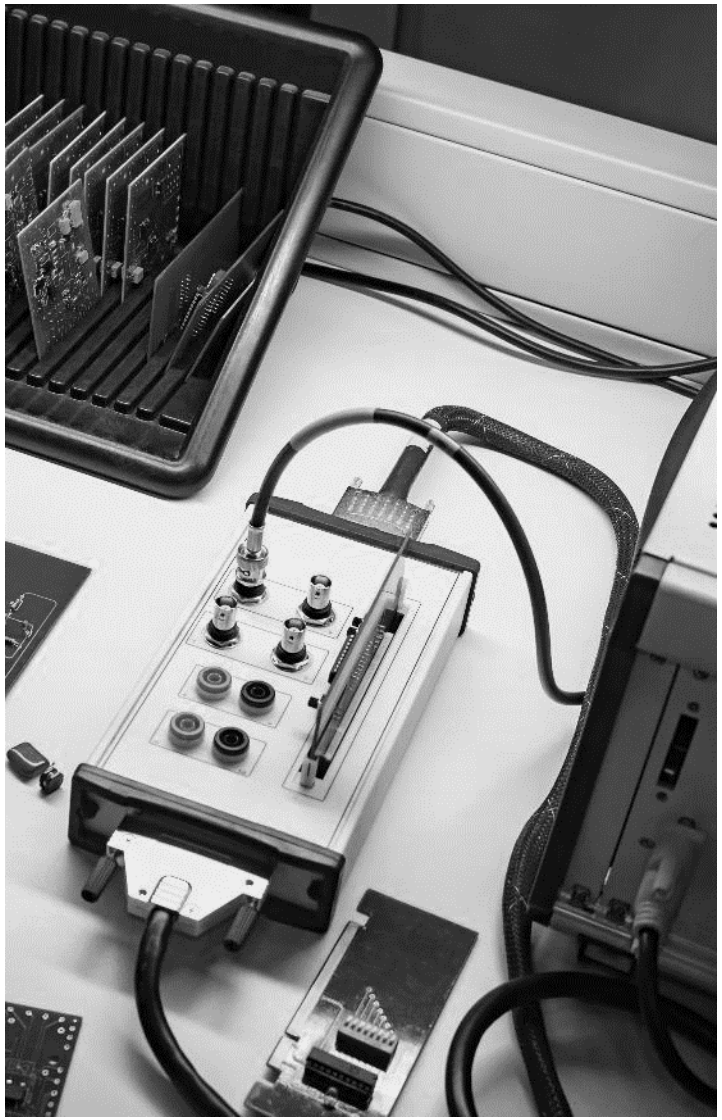
Sam Roundy –
sam@testeract.com
20+ years Automated Test
CLA, CTA, LabVIEW Champion
Grew up on a farm

VP R&D

Garry Garrett
garry@testeract.com
20+ years Automated Test
CLA, CTA
Grew up on a farm

ABOUT TESTERACT

Specialize in Automated Test Software and Test Systems
40+ Engineers
(LabVIEW, TestStand, Python, C#, Databases, Test Hardware)
Founded: 2015
TestPoint Framework
contact@testeract.com



In This Presentation

VISION: TEST IN DIGITAL ENGINEERING

WHAT IS AUTOMATED TEST ENGINEERING TO US

THE ROLE OF TEST IN THE PRODUCT LIFE CYCLE

DIGITAL TWINS IN TEST ENGINEERING & TESTING THE VIRTUAL SYSTEM

APPLYING TESTERACT'S TESTPOINT FRAMEWORK

THE WORKFLOW

ADVANTAGES

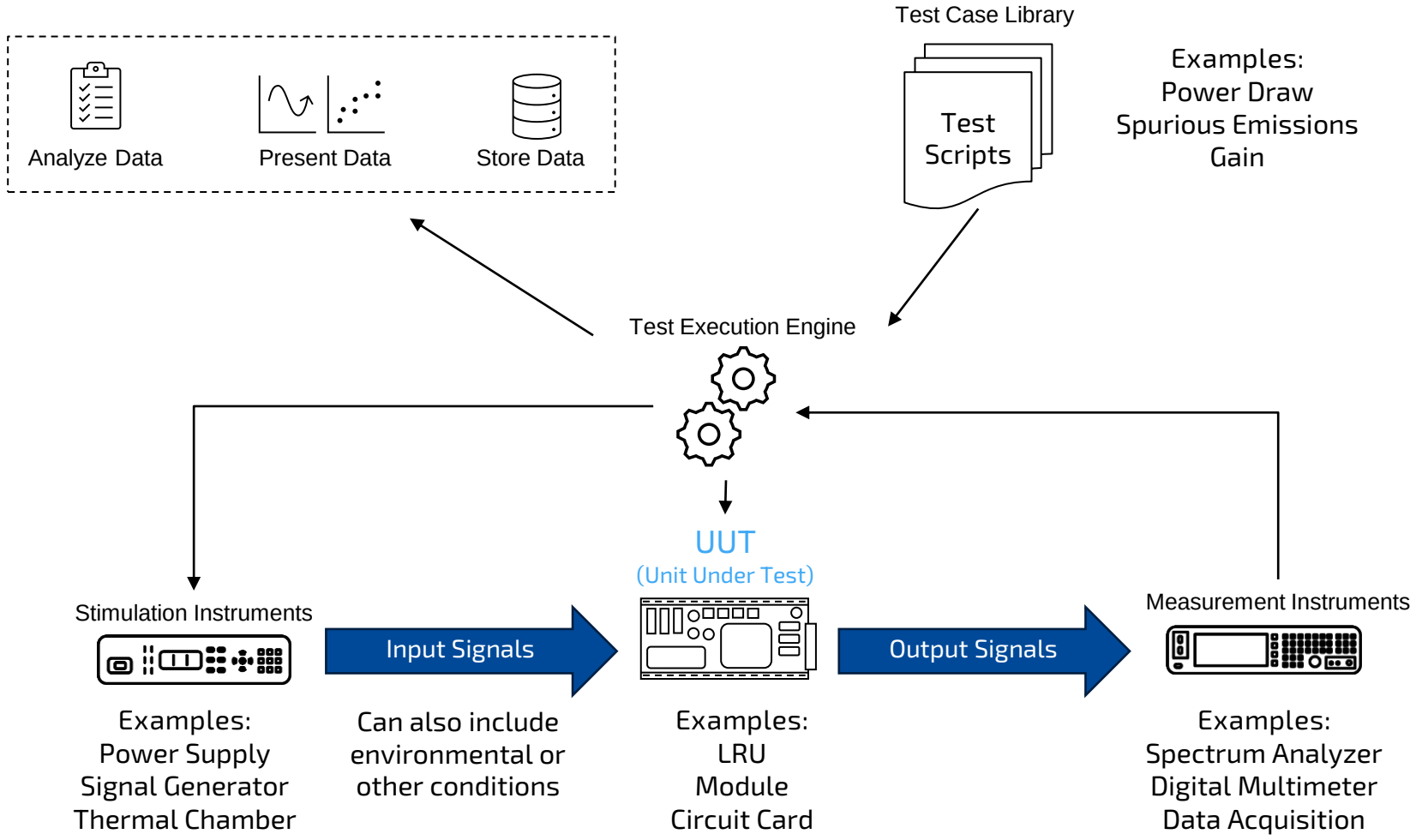
GOALS

ENABLING MORE WITH MODEL-BASED TEST ENGINEERING (MBTE)

WHERE WE ARE AT TODAY IN MBTE

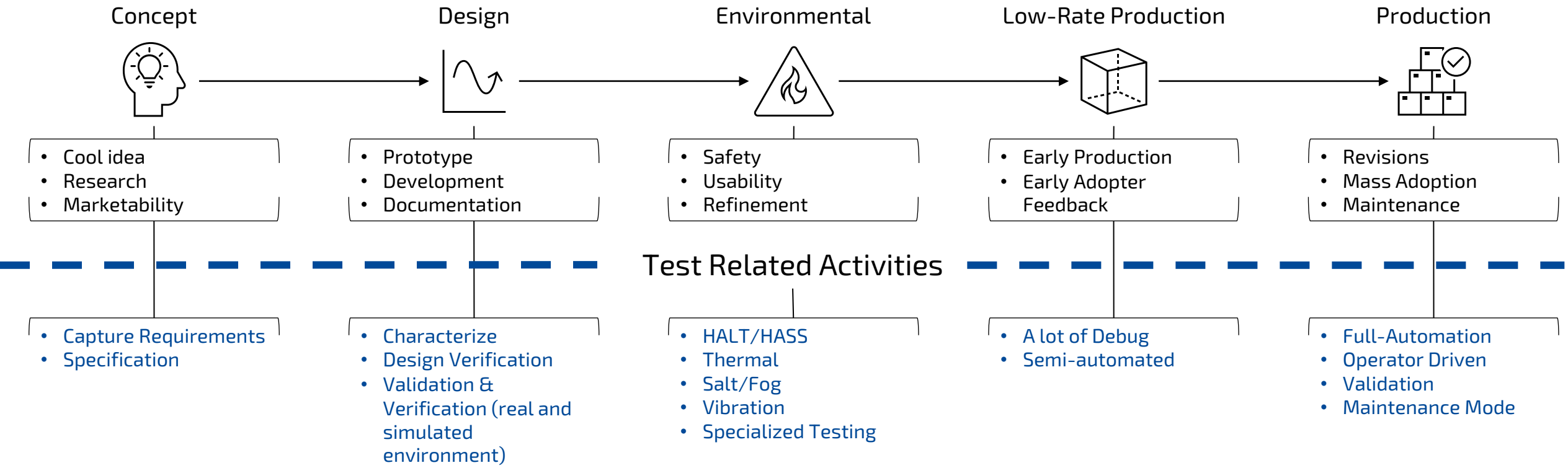
Testeract

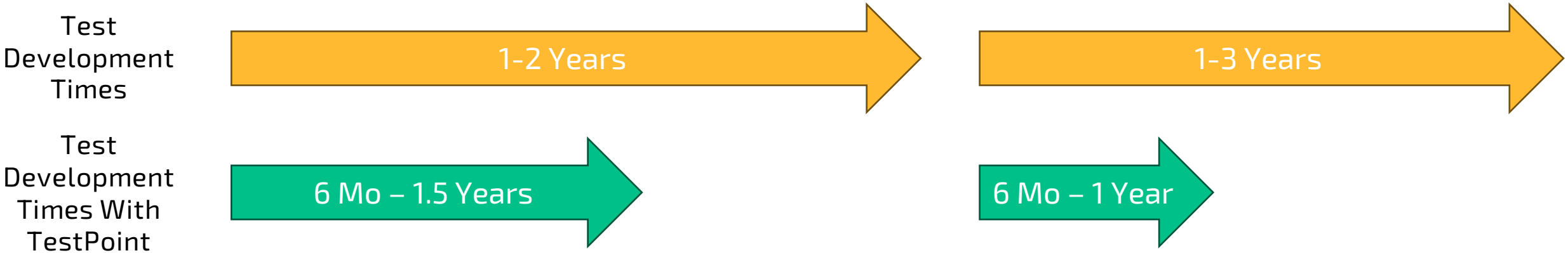
What is Automated Test Engineering to Us?



The Role of Test in the Product Life-Cycle

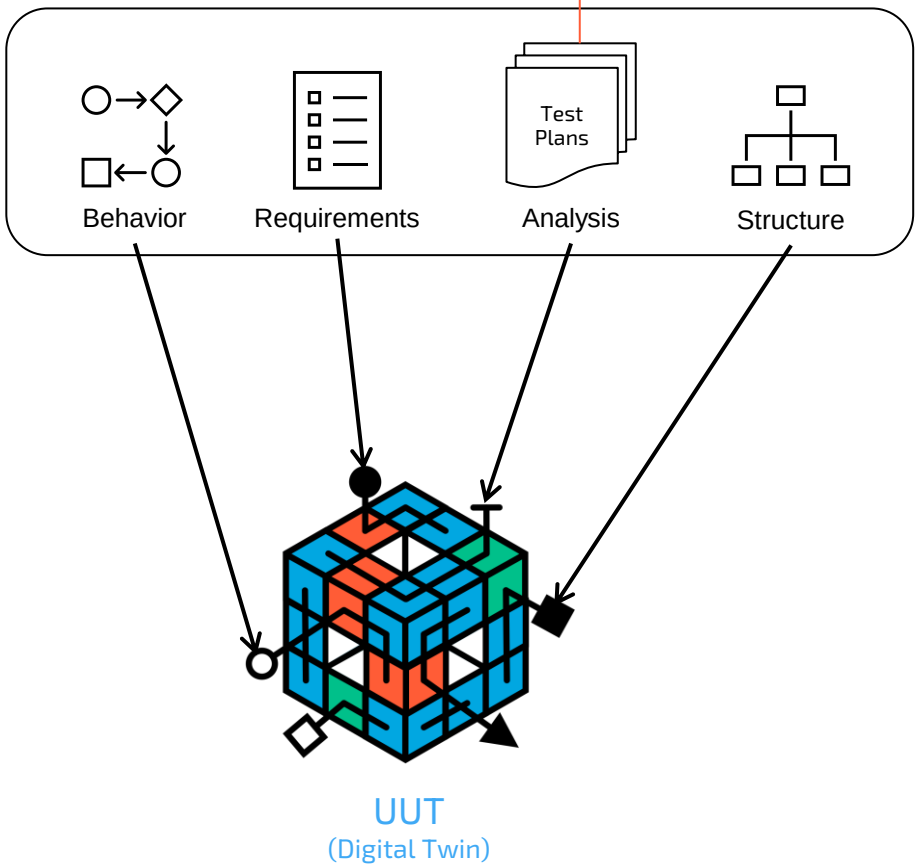
Testeract





What is Digital Engineering?

- This needs to be part of the model
- MBSE
- Derived from requirements

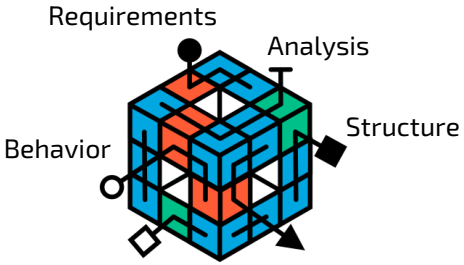


Digital Engineering is the construction of digital (computer) models that represent every characteristic of a complex product or system that is to be developed.

Testeract

Digital Twin Goal

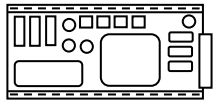
Goal:
Same Behavior for both virtual and Physical



UUT
(Digital Twin)

Virtual

=



UUT
(Unit Under Test)

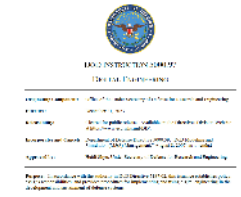
Physical

Why the push? Requirements, Faster Time To Market

Congressional Research Service
Informing the legislative debate since 1914

Acquisition Reform in the FY2016-FY2018 National Defense Authorization Acts (NDAAs)

Updated January 19, 2018



DoD Instruction 5000.97
Digital Engineering
Dec 2023

Flow Downs

Programs

UUTs

PLUS
- Internal Digital Transformation Initiatives
- Not Limited to Defense…

Lots of Questions….

Model-Based Systems Engineering

Models

Design Tools & Workflows (EDA, CAD)

Digital Twins

Digital Threads

Integrated Diagnostics

Simulation

Test Modeling, Tools & Workflows

Authoritative Source of Truth

… And Many More…

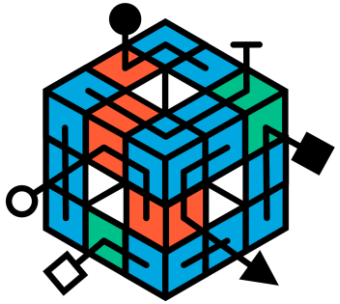
Testeract

A DoD and Industry Challenge/Opportunity

DoD defines digital engineering as an integrated digital approach that uses authoritative sources of system data and models as a continuum across disciplines to support lifecycle activities from concept through disposal….digital engineering emphasizes continuity of the use of models across the lifecycle

— "Digital Engineering Strategy," Office of the Deputy Assistant Secretary of Defense for Systems Engineering, U.S. Department of Defense, page 3, June 2018.

Models of UUT



Consider Additional Models

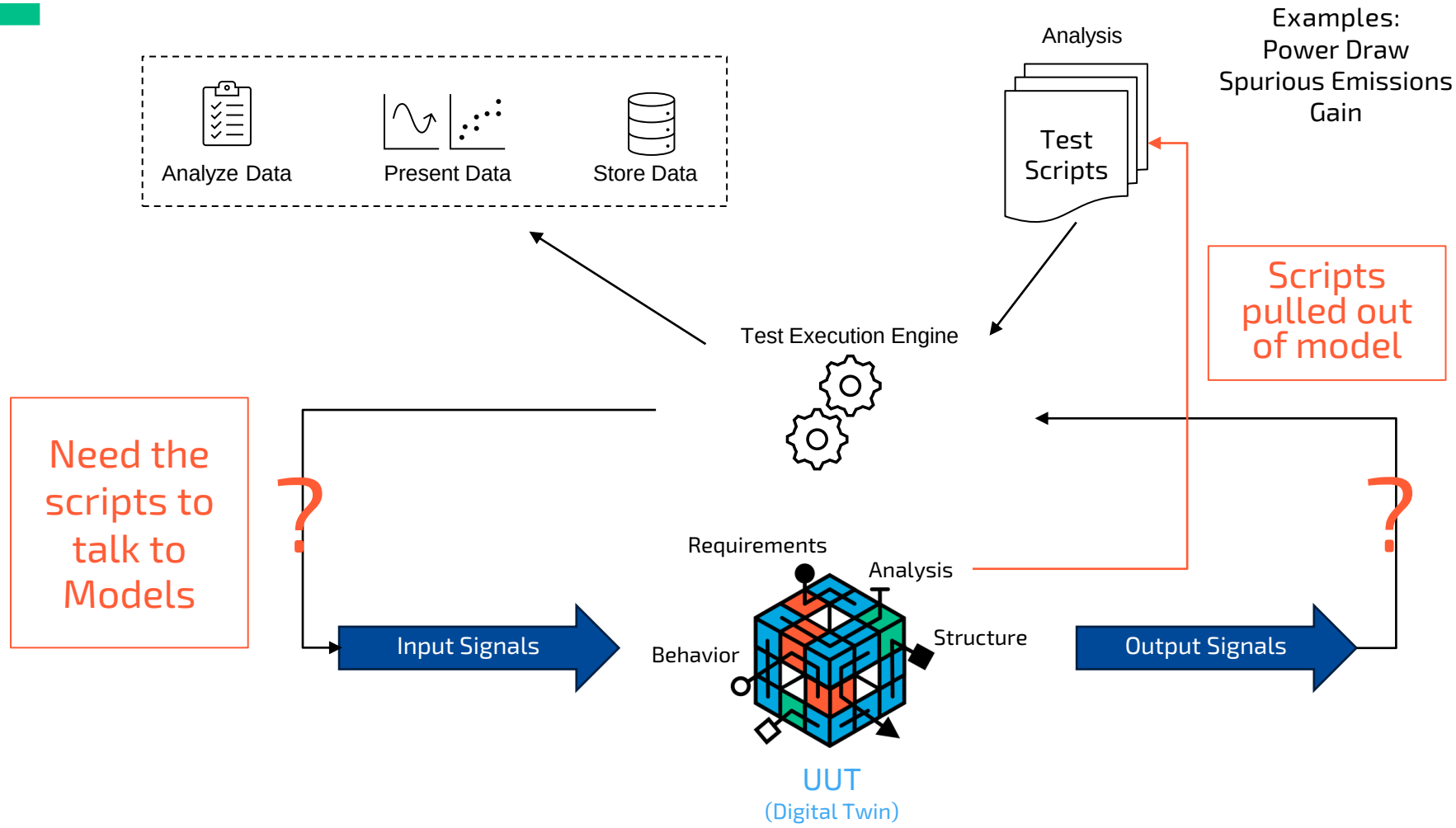
- Models of Test Requirements
- Models of Test Capabilities
- Models of Test Assets/ATE
- Models of Instruments

Potential Additional Value

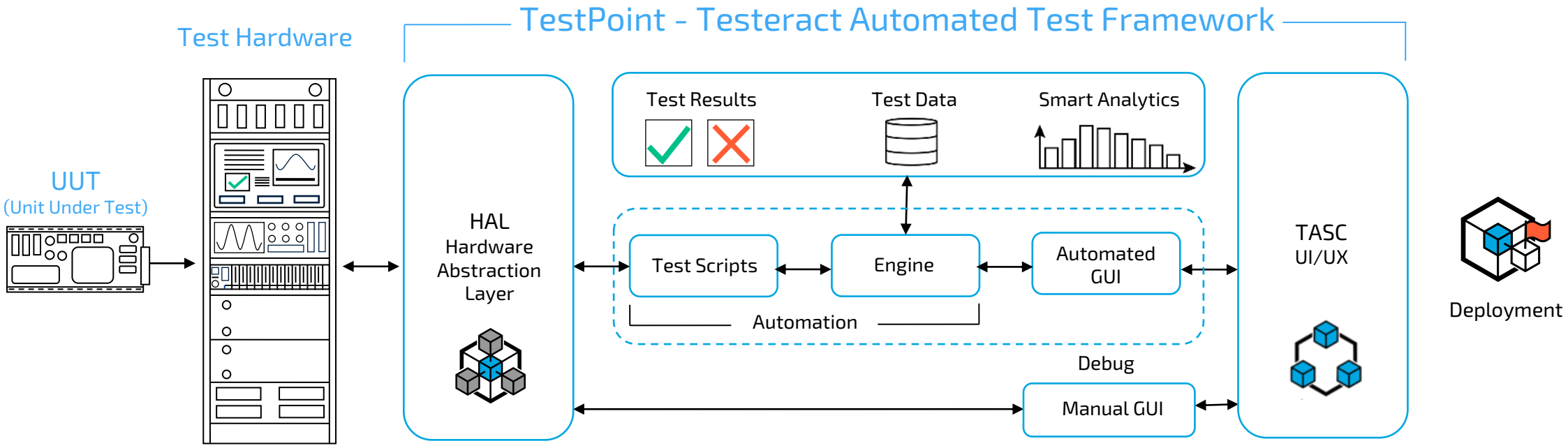
- Simulation of Test
- Acquisition and other analyses
- Knowledge capture
- Models are exchanged, not documents
- Auto generation of Test Scripts'
- Auto generation of ATE
- Full requirements traceability
- ATE Life cycle support
- And more…

Testeract

Testing the Digital Twin

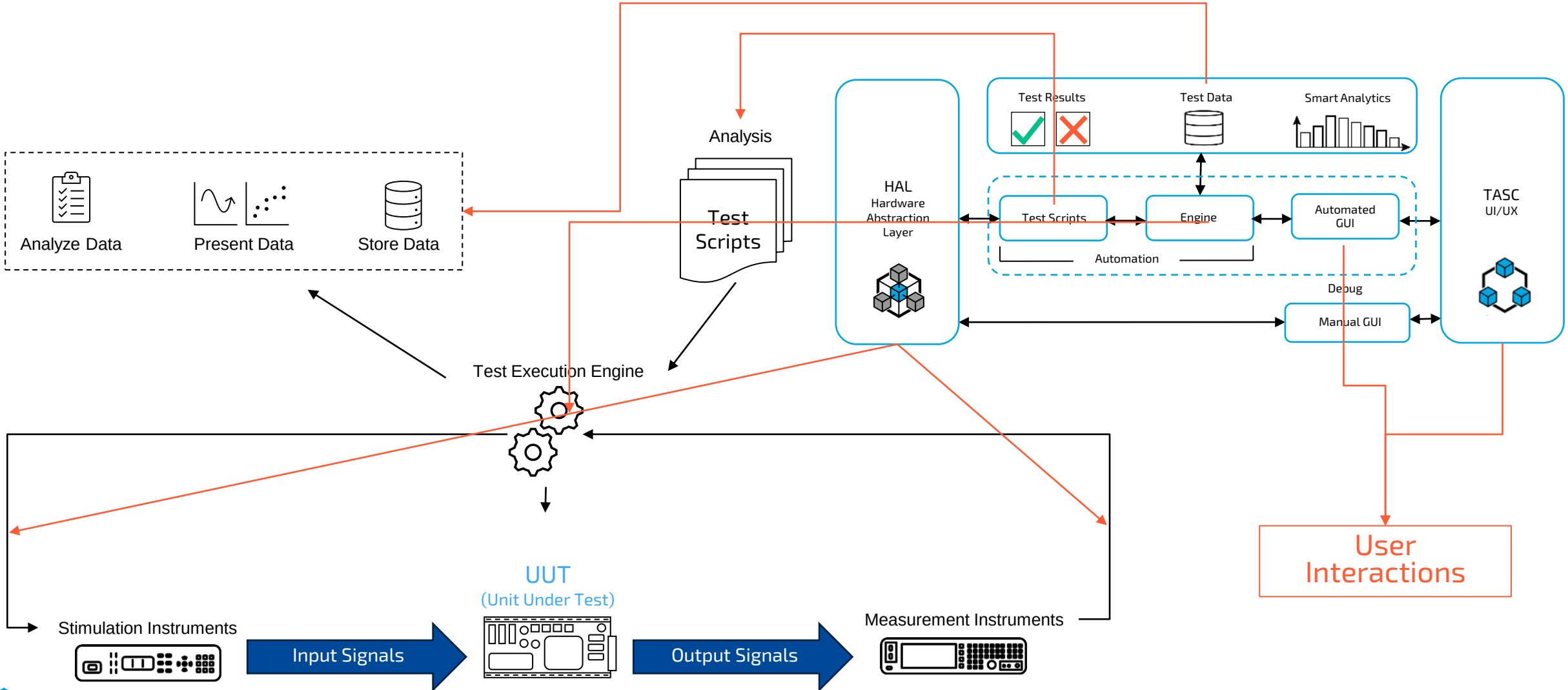


Applying Testeract's TestPoint Framework



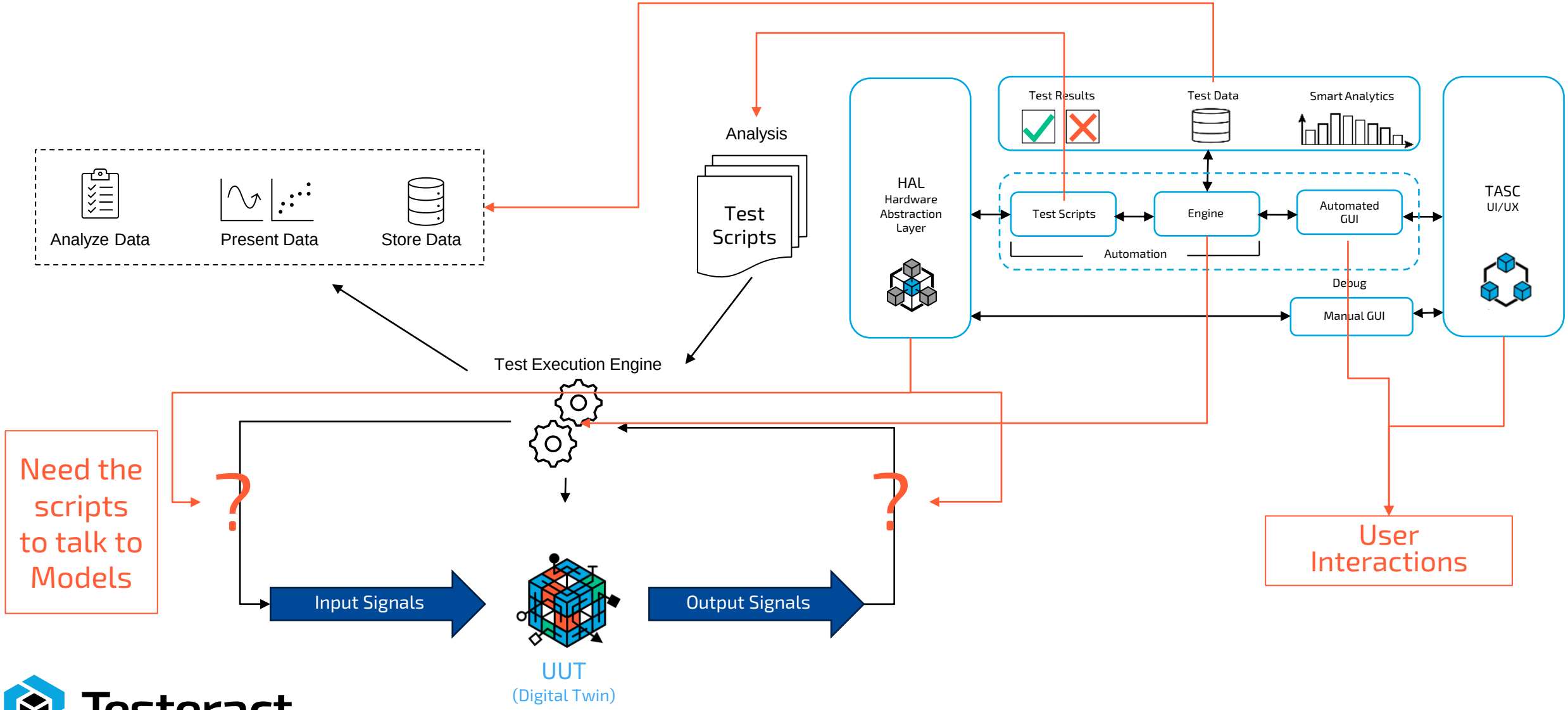
- Test Engineers only need to build what's unique to their UUT
- HAL allows for any type of instruments
- Debug tools empower engineers
- Deployed to hundreds of machines

Applying Testeract's TestPoint Framework



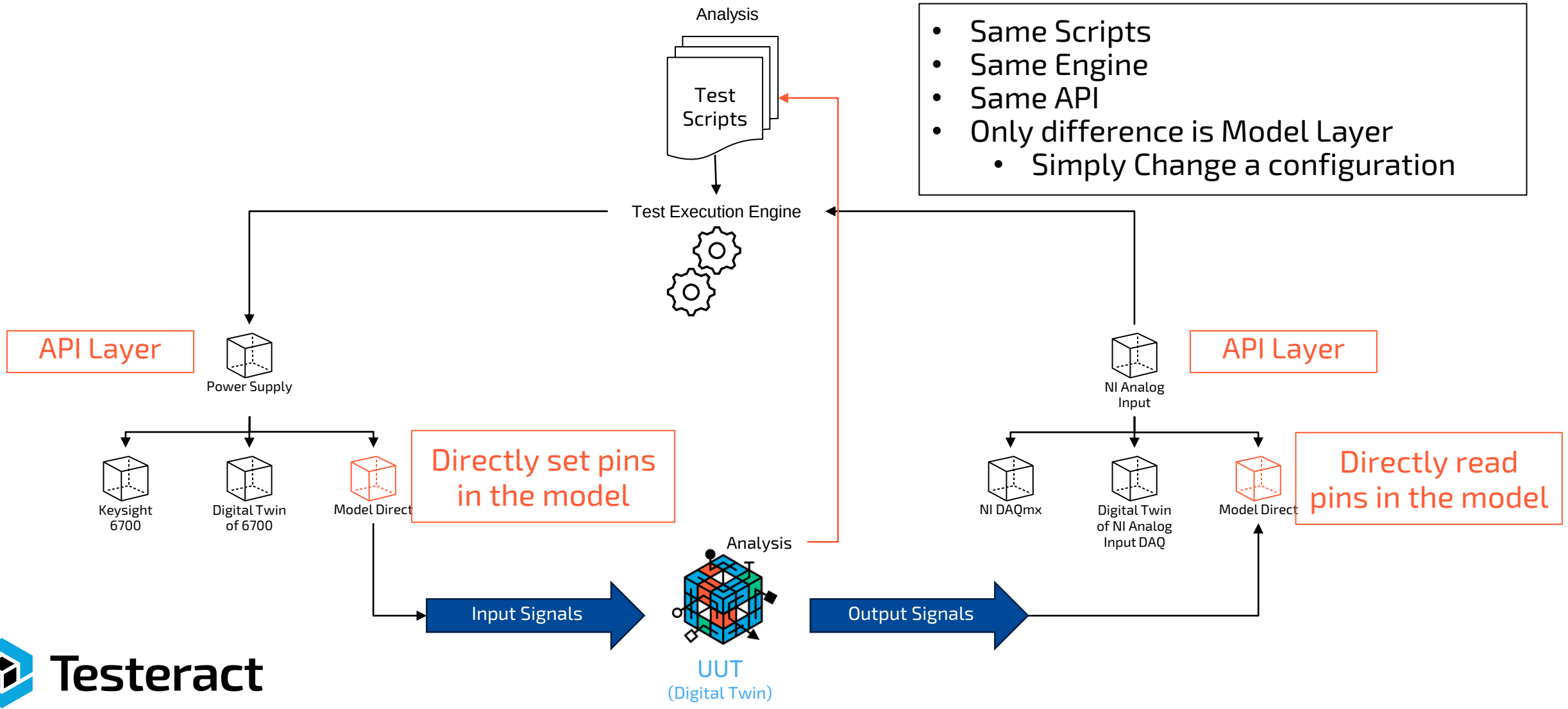
Testeract

Applying Testeract's TestPoint Framework



Testeract

Applying Testeract's TestPoint Framework
Hardware Abstraction Layer – HAL – Model Direct Testing

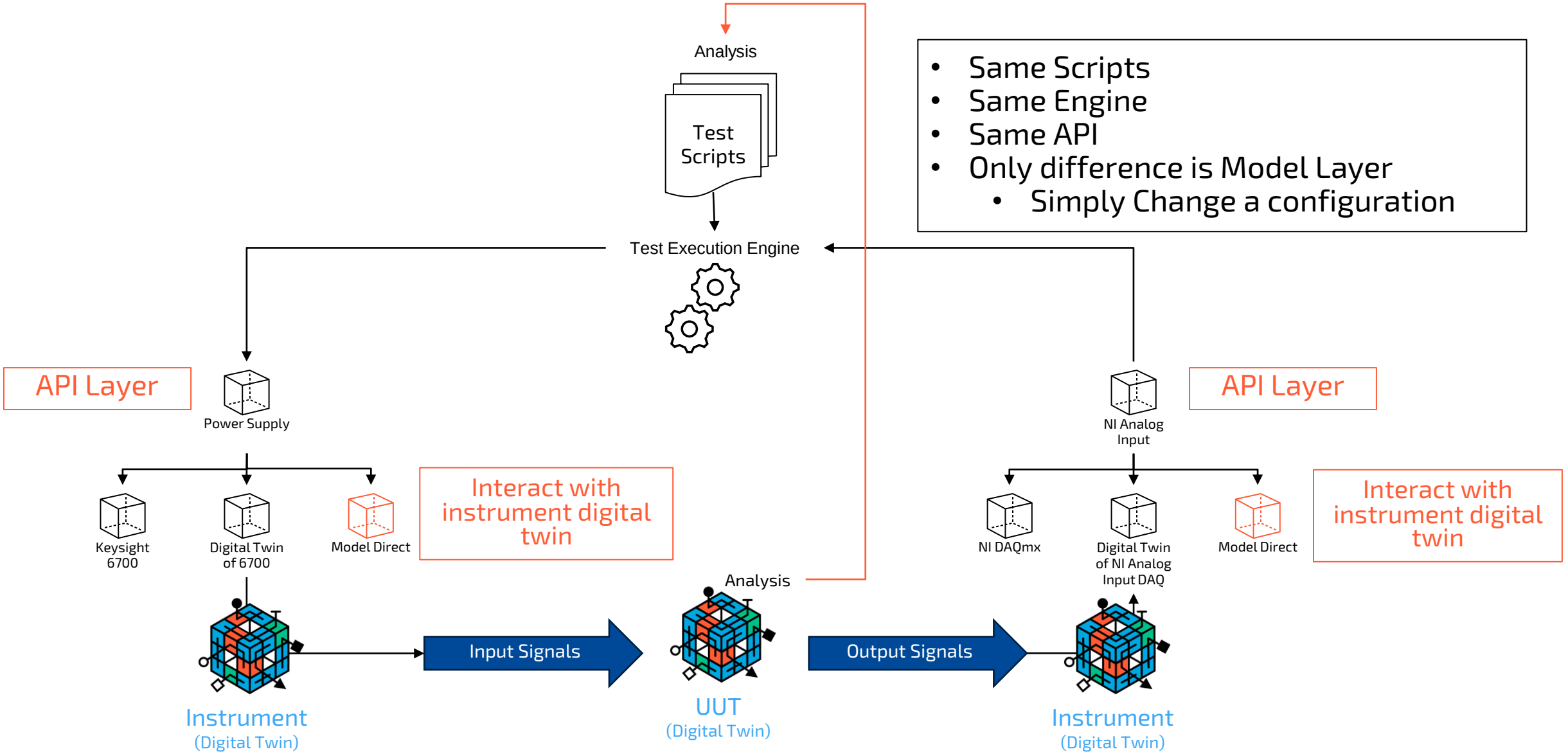


- Same Scripts
- Same Engine
- Same API
- Only difference is Model Layer
  - Simply Change a configuration

Testeract

Applying Testeract's TestPoint Framework Hardware Abstraction Layer – HAL – Dig Twin Instr Testing

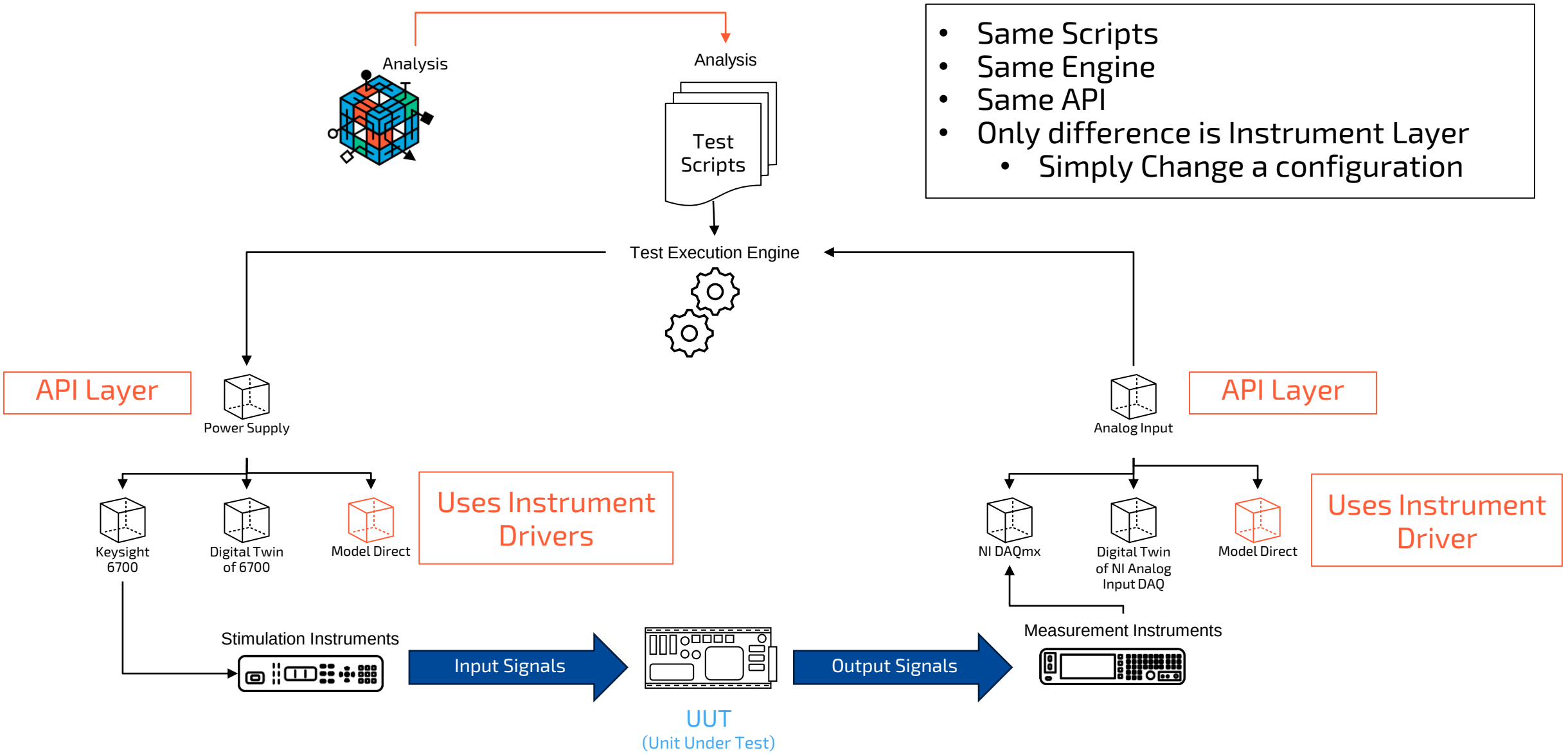
Testeract



- Same Scripts
- Same Engine
- Same API
- Only difference is Model Layer
  - Simply Change a configuration

Applying Testeract's TestPoint Framework
Hardware Abstraction Layer – HAL – Physical Testing

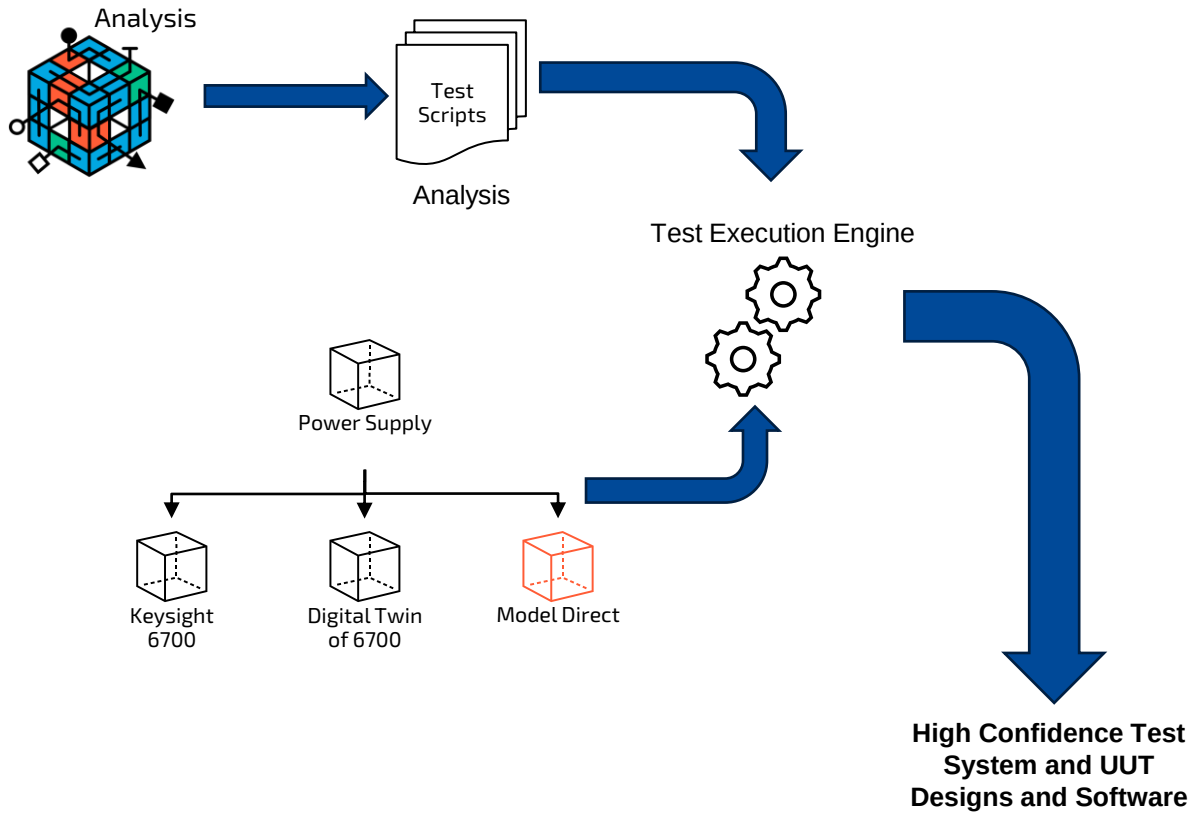
Testeract



- Same Scripts
- Same Engine
- Same API
- Only difference is Instrument Layer
  - Simply Change a configuration

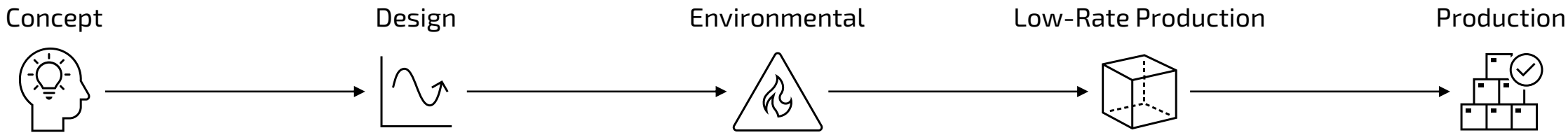
Test Development Process

1. Test Scripts autogenerated from Models and are part of asset libraries
   - Test Scripts are Executed by TestPoint engine
2. TestPoint HAL Plugins for UUT & Instruments Digital Twin and physical Instrument created
3. Digital Workflows Tested, Validated
   - UUT Direct
   - UUT + Test Instruments
4. High confidence physical Test bench created, Tested – No Test Script Changes
   - Physical Test System with UUT
5. No changes at the application, algorithm layers
   - Config changes only from Digital to Physical
   - Reusable digital assets



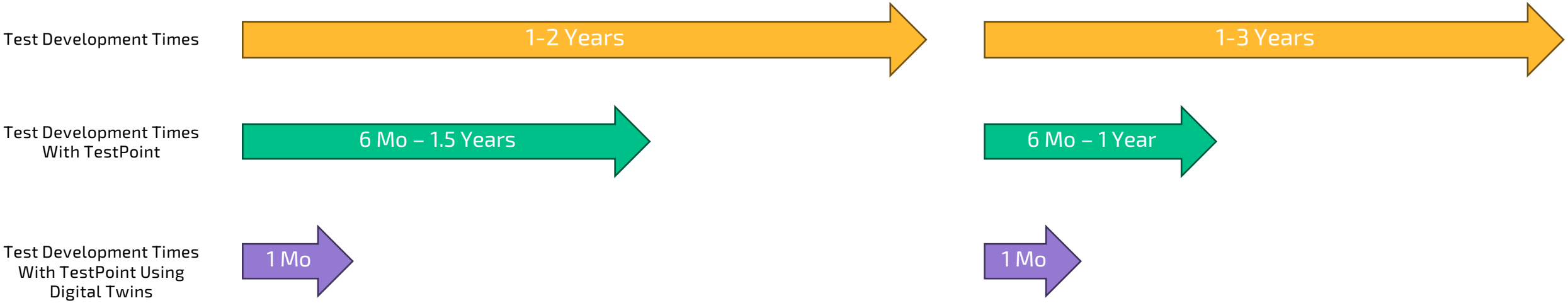
Advantages

Testeract



Test Related Activities

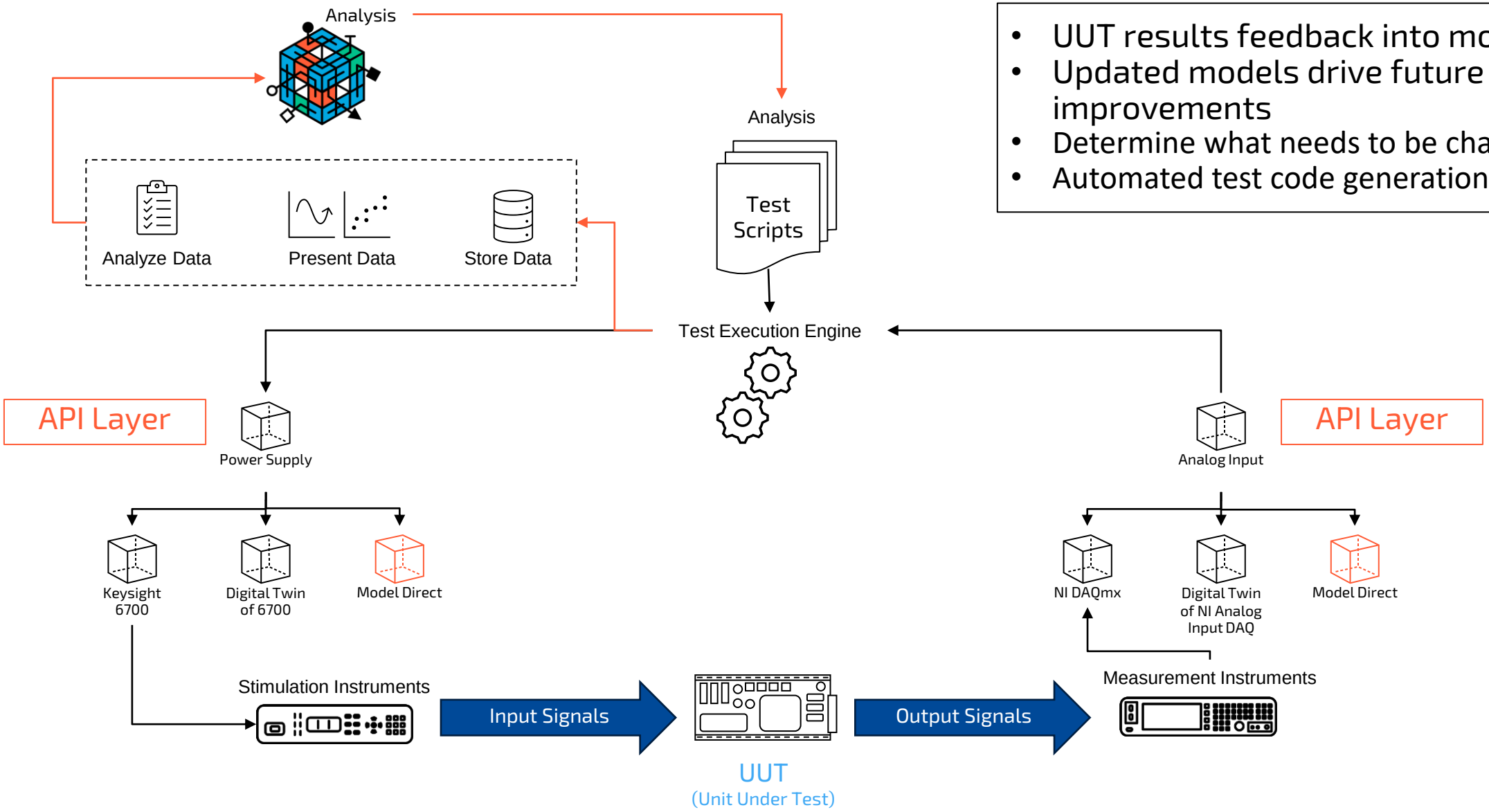
Concept	Design	Environmental	Low-Rate Production	Production
• Capture Requirements • Specification	• Characterize • Design Verification • Validation & Verification (real and simulated environment)	• HALT/HASS • Thermal • Salt/Fog • Vibration • Specialized Testing	• A lot of Debug • Semi-automated	• Full-Automation • Operator Driven • Validation • Maintenance Mode



- Decrease time to production
- Requires less skills to generate tests

Digital Thread feeds back into models (MBTE)

Testeract



- UUT results feedback into models
- Updated models drive future improvements
- Determine what needs to be changed
- Automated test code generation

SBIR – Testeract Awarded

- Testeract has now been awarded an SBIR for Digital Twin
- Looking for partnerships

Testeract

Shout Out

- Special Thanks to Greg Brown (ni)