

# **Integrated Modeling and Testing PET Annual Technical Review Accomplishments and Future Vision**

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**National Center for Supercomputing  
Applications**

**University of Illinois**

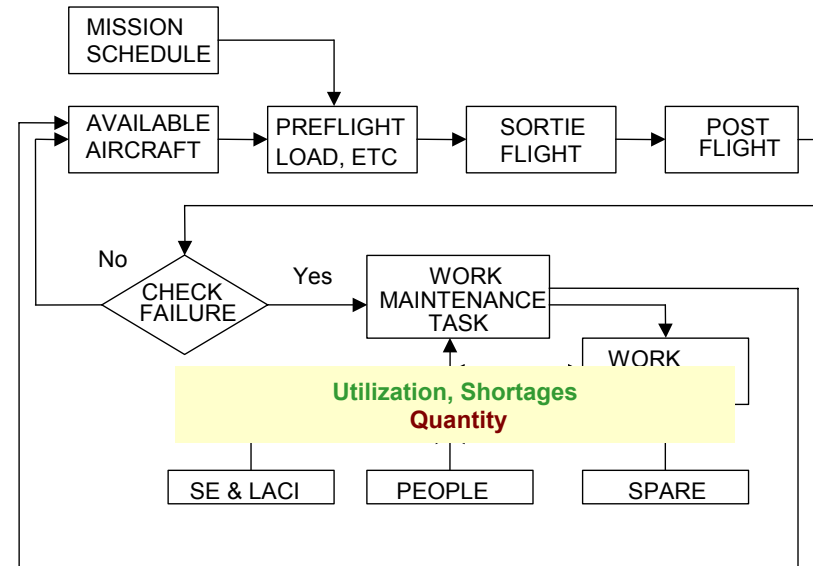
- **On-sites**
  - **Bob Yan - AEDC**
  - **Pending Hire - ARL**
    - **Sonetra Wilburn, February 11**
    - **Walter Landry, February 13**
  - **Jack Benek – DC Requirements Reviews**
- **NCSA Team**
  - **Miranda Callahan**
  - **Rob Kooper**
  - **Cameron Jones**

- **Rebuild The IMT Program**
  - **Find And Hire On-site Staff And Academic Staff**
  - **Establish Core Advisory Groups**
  - **Generate Project Pipeline**
- **Finding An Approach For Building A Broadly-Based DoD Team And Programs**
  - **Range Commanders Council**
    - **20 Plus Test, Training, and Operational Ranges**
    - **Membership On Data Reduction And Computer Group (DR&CG) And Modeling And Simulation Sub-groups**
      - **Funded Lead On Data Management Survey And TENA Object Model Approval Process Definition Tasks**
  - **CTEIP – FI 2010 Program Participation**
    - **CTTRA Workshop Participation And TENA Architecture Management Team Participation**

- **On-site Activities Are Usually Coordination Or Exploratory Efforts**
- **Typical Example: Assist on CHSSI Project Technical Issues**
  - **Bob Yan Identified Potential Replacement Code For The MATLAB GridData Function Used In CHSSI IMT-05 RTTC Infrared Scene Projection System**
  - **By Identifying C/C++ Code Implementing The QHull Algorithm, Bob Opened Up A Potential Path For Parallelizing Code In Future Developments**
  - **Key Users: Mark Manzardo, Lisa Grelier, RTTC, Jere Matty, CHSSI Portfolio Lead**

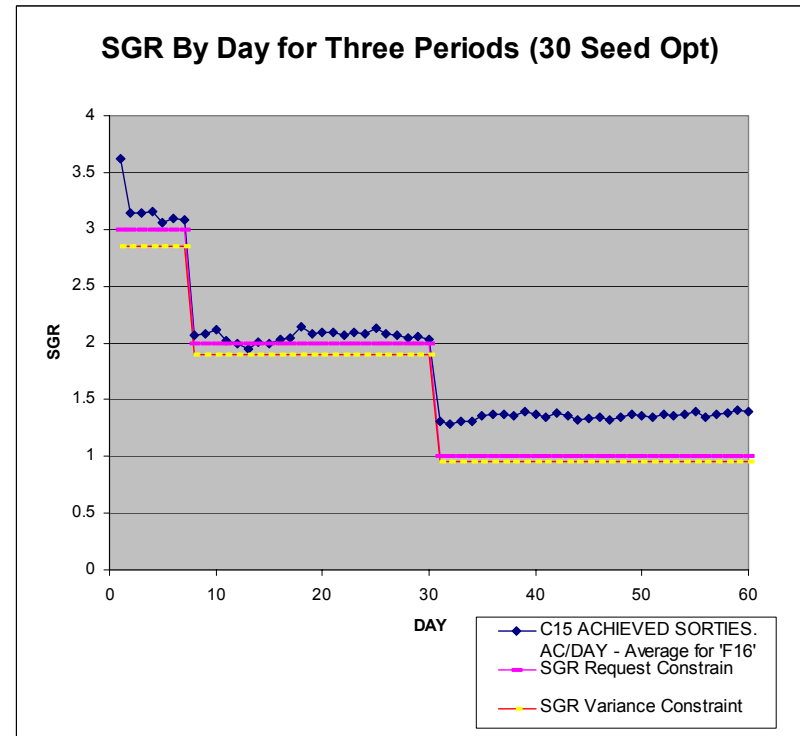
## Deployment Logistics Planning Optimization /Thompkins/NCSA - UI

- **Goal: Optimization Strategy (Procedures, Policies, And Algorithms) Implementation For LCOM That Minimizes The Number Of Spares And Manpower Resources Needed To Meet Multiple Operational Constraints**
- **Approach: NCSA- ASC/ENN Team**
  - Kevin Cho: NCSA
  - Gregory Dierker And Frank Erdman: ASC/ENN
- **Completed A 3 Year Effort By Developing:**
  - Simplified User Interface
  - More Capable HPC Back-end
  - Generic Simulation Code Wrapping Capability



## Logistics Common Model (LCOM)

- **Major Accomplishments**
  - Application Process Cycle Time Reduced From 3 - 4 Weeks To Overnight
- **Technical Challenges**
  - Generic Wrapper Process
  - Robust Optimum Solution
- **Key Deliverables**
  - Validated Software For Distribution Operation, PC-Unix

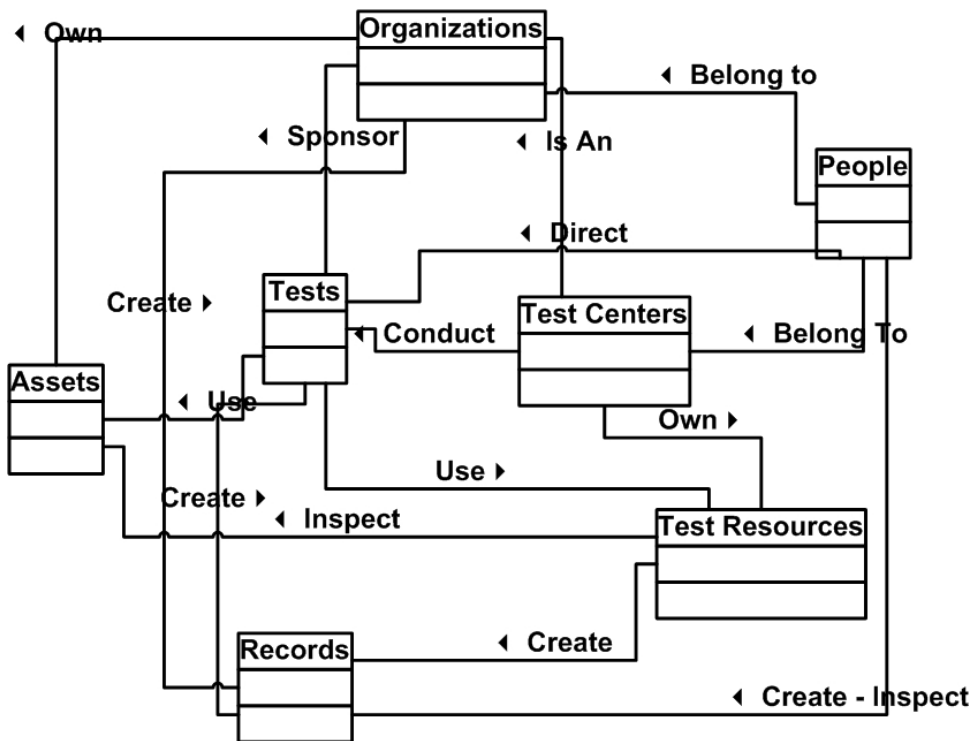


- **Project Follow-on Efforts**
  - Expanding The Optimizer's Current Sortie Generation Rate (SGR) Capabilities To Additional Statistics Such As A Composite Mission Capable Rate Measure
  - Cost Modeling Of All Consumable Resources
- **DoD Needs**
  - Integrate Data Warehousing & Data Tools With Optimization Support
- **Future Efforts Should Include**
  - Integration Of Force-level Simulation Tools
  - Spares Consumption Data Mining To Provide Realistic Forecasting Based On Field Experience

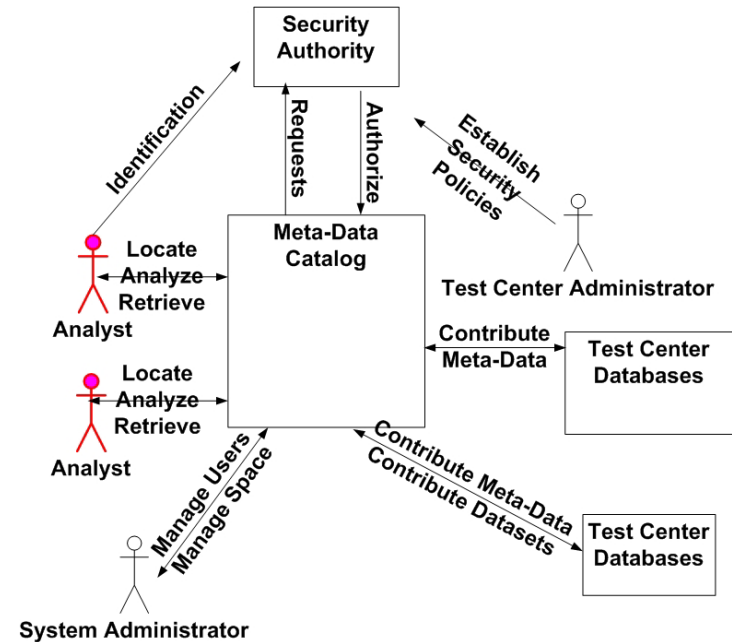
## Data Repository Infrastructure Evaluation /Thompkins/ NCSA - UI

**Goal: Demonstrate In Realistic DoD Settings And Tasks An Information Architecture That Allows Analysts To Create A Coherent, Persistent View Of Distributed Test And Evaluation Data**

### Domain Model



### Software Architecture



**Current Development  
Collaboration With RTTC ILH  
Group Led By Dave Browning**

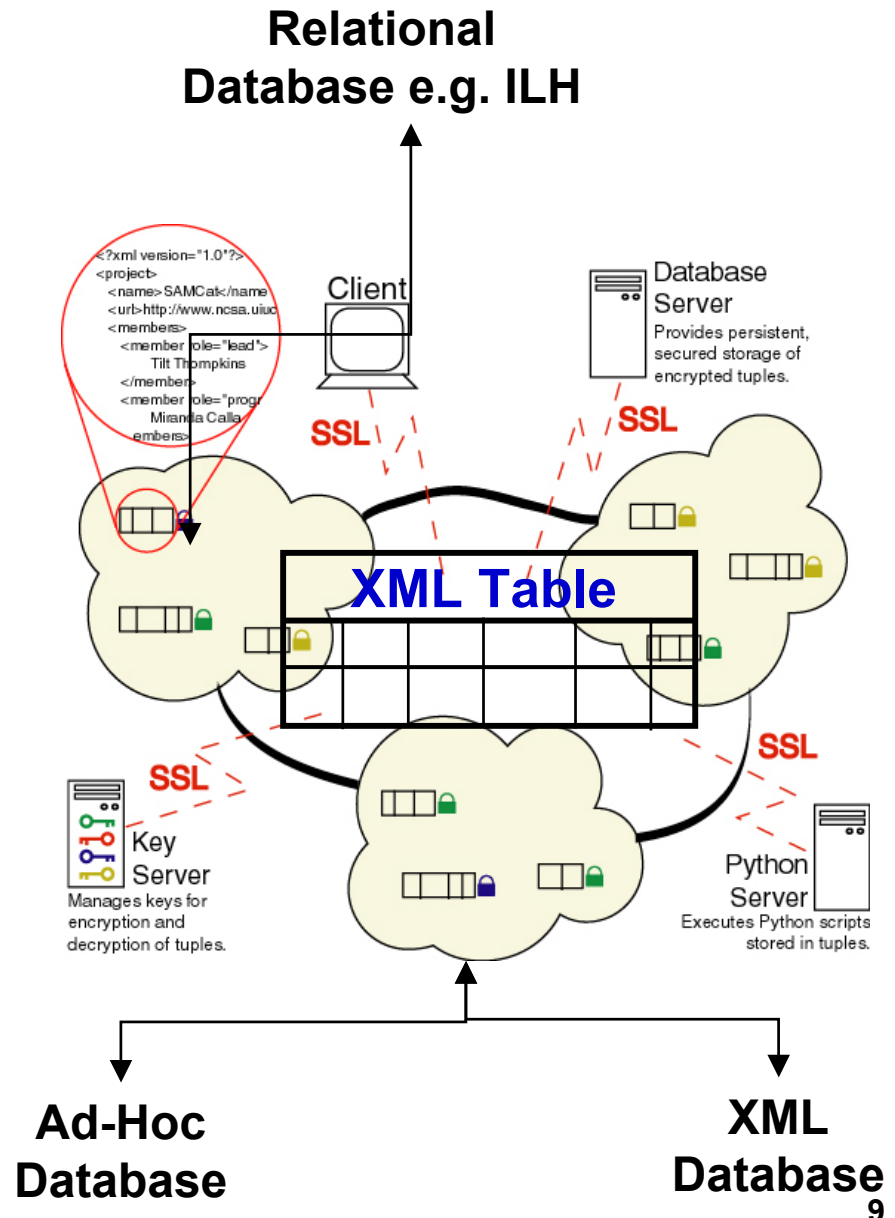
## Accomplishments To Date:

- Domain Object Model
- Distributed XML Table Data Structure

## Technical Challenges:

- Maintaining High Performance In Terms Of Usability, Ease Of Installation, And Transmission Capacity
- Security Architecture

Key Deliverable Is Prototype Installed At 2 DoD Locations



## **DoD Requirements:**

- The Variety And Quantity Of Data Collected Makes Direct Application Of Data Mining Techniques Impractical**
- Achieving Productive Re-use Of T&E Data Requires A Multi-tiered Approach Of Distributed Repositories Supporting Data Fusion And Data Visualization As Well As Application Of HPC Resources To Support Large Scale Repositories**

## **Follow-on Work:**

- FY04 Proposal To Build An Integrated Data Repository For Stores Separation Using RCC Identified Data Sets**
- FY04 Proposal To Build A Demonstration Data Repository On Linux Clusters**

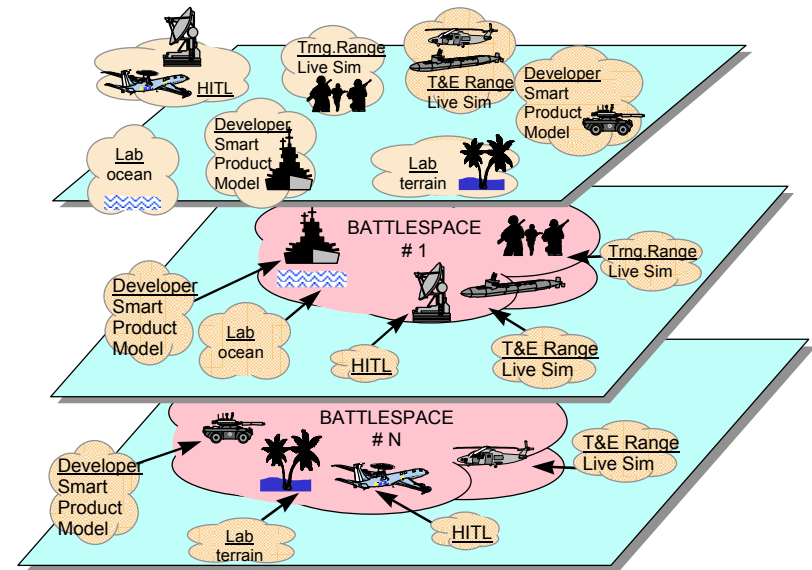
## Real-Time Interoperability Protocol Study /Thompkins/ NCSA - UI

### Evaluate Potential Advantages of Commercial and Emerging Protocols to Interface with TENA Logical Range Architecture

- For Example JINI, Openwings, Salutation

### Compare On The Basis Of:

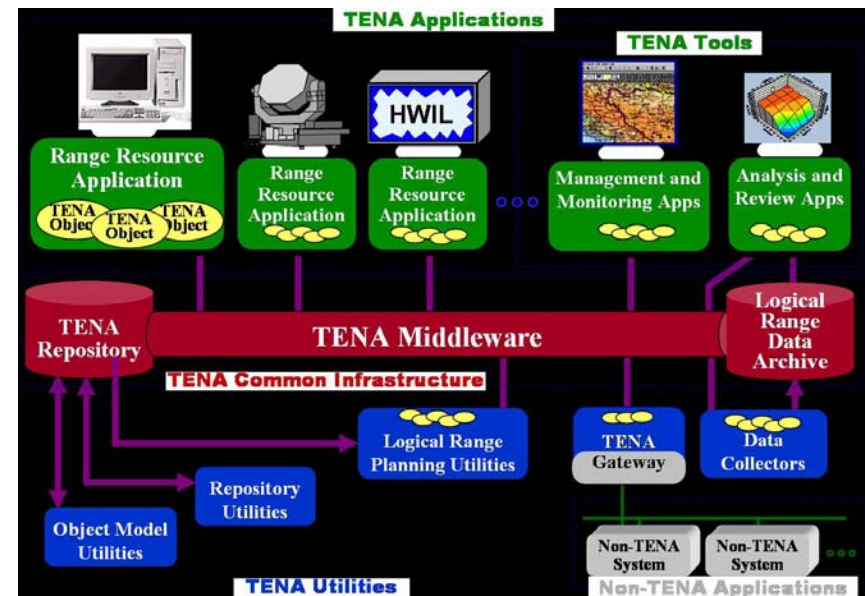
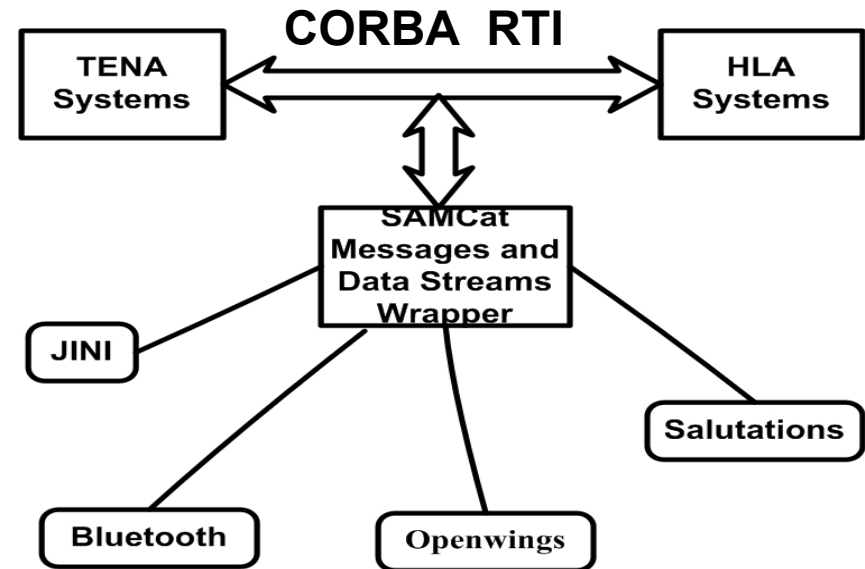
- Platform And Language Independence
- Ad-hoc Service "Discovery" Process
- Interoperability With Other Connectivity Architectures
- Fault Tolerance
- Classification Level Security
- Requirement For A Single, Common Object Model Or Data Dictionary



DOD Users Supporting Proposal: JTIC- Kenneth Thomas, InterTEC – Robert Helman, Pacific Ranges and Facilities Development – Richard Stahle, Army Operational Test Command – Henry Merhoff,

FI 2010 TENA Team: George Rumford, Jerry Santos

- **Accomplishments To Date**
  - TENA Middleware Installed
  - HLA Suite Installed
- **Technical Challenge**
  - Protocol Integration Hub
- **Key Deliverable**
  - Report To RCC DR&CG And TENA AMT



## **DoD Requirements:**

- Test Ranges Are Moving Toward Greater Interoperability At The Test Resource Level**
- Variety Of Existing Devices And Rapid Pace Of Middleware Evolution Precludes Standardization On Any Single Protocol**
- Variety Of Gateway Approaches Will Be Needed**

## **Follow-on Work:**

- FY04 Proposal For HPC Protocol Integration Into TENA**

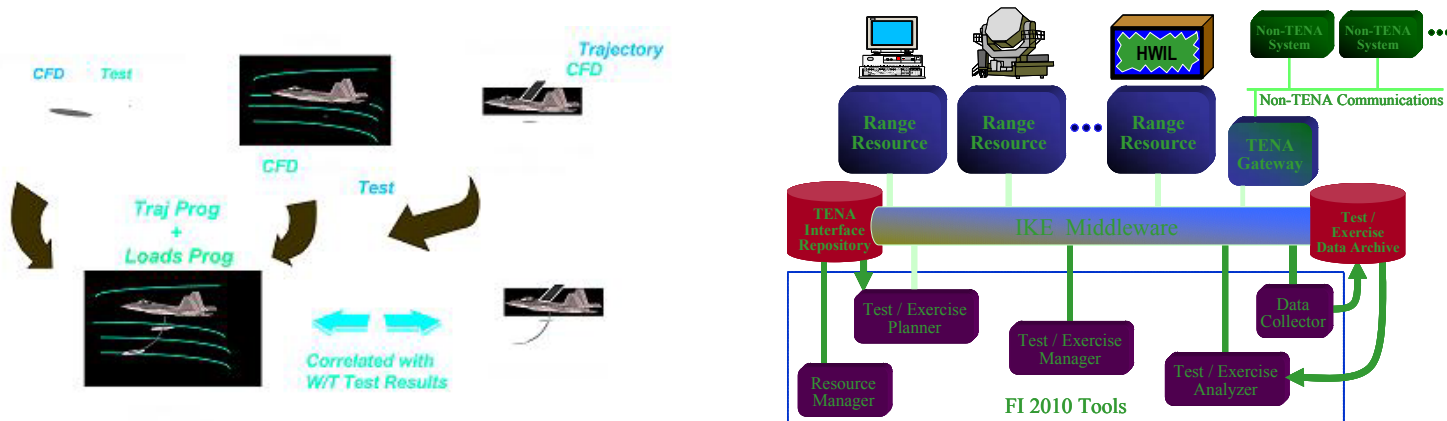
- **FMS and IMT joint project – Data Reduction**
- **Provided Recommendations on Data Repository Requirements for CE-03-006 Project**
  - **PI: David Cronk, University of Tennessee**
- **SGL Training Requirements for RTTC (Kevin Dennon)**
  - **Coordinated With ET Program, Robert Moorhead**

- **UAP Group Is Highly Desirous Of Additional HPC Support But:**
  - Questions If HPC Program Is Serious About T&E
  - Wants Priority Access To Queues That Match Challenge Projects
  - Needs for Data Management to be Elevated in Priority
- **Recommendations**
  - Provide Much More Hands-On Training and Demonstration Help On Linux Clusters
  - Continue Focus On Distributed Simulations And Testing

- **Major Challenges**
  - **Wide-range Of T&E Activities To Be Supported**
  - **Real-time Processing And Networking Requirements In Addition To Computing And Storage**
  - **Likely Transition To Local Clusters**
- **Good Feedback From Range Community, But Need to Balance With More Feedback From Development Community**
- **Must Understand What Are The Development Test Links That Are Not Covered By Other PET Functional Areas**

## Tight Integration of Simulation, Developmental Testing, and Operational Testing Will Be Driven By:

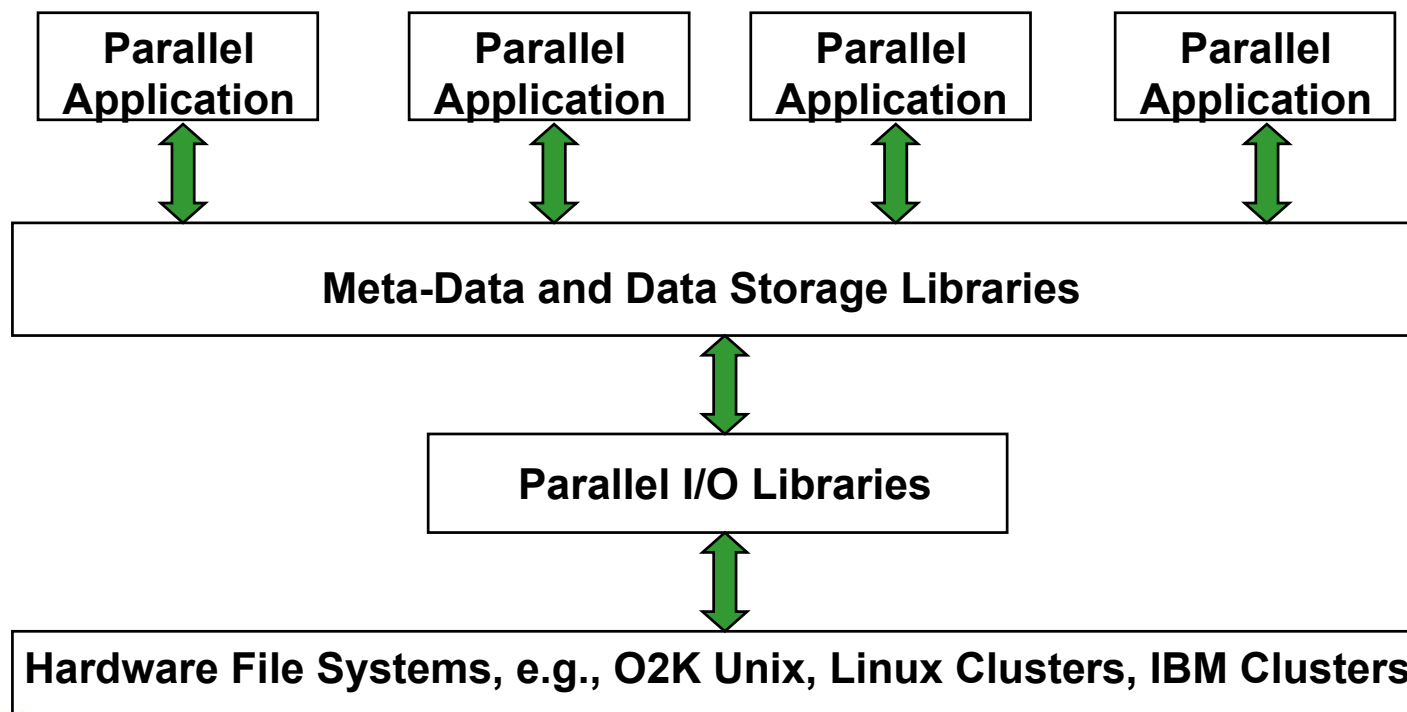
- Cost – Schedule Pressures, e.g., FCS
- Technology Opportunities, e.g., AEDC IT&E Process and TENA



**IMT Opportunity Is to Shape Software Architectures So That Test Integration Through High Performance Simulation Begins Early and Components Can Be Replaced By Hardware As Available And Appropriate**

**T&E Data Is Accumulating At A High Rate, Estimated At 100's of Terabytes per Year.**

**IMT Opportunity Is To Facilitate Collection, Retention, And Access To Applications And Analysts.**



- **Requirement - Distributed Simulation And Systems Of Systems Testing**
  - The Ability To Test Entities Which Are Intrinsic Systems Of Systems, Where Various Components And Sub-components Will Mature At Various Times And In Disparate Geographic Locations
  - Supports CHSSI CST And SOS, FI 2010 TENA, FCS
- **Response: Core Task**
  - Geographically Distributed, Real-time, Performance Monitoring And Prediction Capability For Electro-mechanical Systems Such As Trucks, Tanks, And Turbine Engines
  - Proposed Vehicle Is AEDC On-site, Bob Yan, Working With Mark Chappell
- **Response: White Paper/Proposals**
  - Systematic, Reusable Methods For Conducting Distributed Simulations And Tests, Capable Of Incorporating Hardware/Human In The Loop, Security And Authentication Issues, Real Time Performance, Etc.
  - Proposed Vehicle Is FY04 Project To Integrate MPI Into TENA

- **Requirement - Real-Time Performance**
  - Interoperability As Well As Distributed Simulations And Tests Demand Real-time Response From All Participants: Test Assets, Communication Systems, Monitoring Systems, And Simulations
  - Supports CHSSI SoS and SPG
- **Response: Core Task**
  - A Run Time Infrastructure (RTI) For Communicating Data Among Various Codes And/Or Federates Is Required, However Current RTI's Exhibit Disparate Performance, Usability, Portability, Etc. A Summary Of Existing RTI Performance, Including Platforms On Which They Run, Cost And/Or Availability, Latency Associated With The RTI, Documentation Availability, Bandwidth Restrictions, Compatibility With Existing Data Exchange Standards, Subjective Assessment Of Ease Of Use, Etc.
  - Assigned To AEDC On-site, Bob Yan, and Transfer To ARL On-Site When Hire In Place. Additional References Pulled From Real-time Protocols Study As Available

- **Requirement - Data Management**
  - Capabilities That Improve The Flow Of Information Between Test And Evaluation Centers And Between The Test Centers And The Acquisition Communities So That Expensive And High Fidelity Test Data Can Be Effectively Reused Resulting In A Faster And Improved Weapon System Development Process
  - Supports CHSSI CST, RCC Data Management Integration, VISION, FCS
- **Response: White Papers/Proposals**
  - Integrated Data Repositories For End-to-end Applications Such As Stores Separation
    - Proposed Vehicle Is FY04 Proposal For Stores Separation Meta-data Catalog
  - Parallel Database Servers On Linux Clusters
    - Proposed Vehicle Is FY04 Project To Build Demonstration Cluster. Involve ARL-On-Site To Insure Training and Technology Transfer

- **Requirement - Synthetic Environments**
  - The Ability To Use Synthetic Environments For Testing Sensor Performance, C4ISR, Vehicles, Etc. And For VV&A Of Sensors.
  - Supports CHSSI SPG, CBD
- **Response: White Papers/Proposals**
  - A Method Is Needed For Rapidly Providing Dynamic Multi-resolution Terrain Data In A Multi-layered Manner, Each Layer Incorporating Successive Features (Weather, Time Of Day, Foliage, Vehicles, Soldiers, Etc.)
    - Proposed Vehicle Is Through FMS SEDRIS Effort, FMS-02-004
  - Accurate And Repeatable Testing Of Sensors For Detecting Chemical And Biological Agents Requires Development Of A Simulation Capability For Released Cloud Formation And Transport, IR Energy Transport, And IR Scene Evaluation Suitable For Driving Real-time IR Scene Generators
    - Proposed Vehicle Is FY04 HPC Evaluation Effort With Gary Bodily And Dugway Proving Ground On Dynamic IR Scene Generator