

# Enabling Evidence-Based Modernization (EEBM)

John Klein



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# Outline



**Background and Context**  
**Research Goals and Approach**  
**Results**  
**Future Work**

# Context – Business System Modernization

## GAO: DOD Business System Modernization is a High Risk Area

- “For decades, DOD has been attempting to modernize about 2,300 business systems”
- Majority of 20 selected Major Automated Information Systems (MAIS) had not established their first baselines within two years from program start

These are generally not unprecedented problems – viable solutions exist

Challenges are not technical – the problem is to choose a solution

Users of the current system carry extra weight in any discussion about the way forward

# Research Goals and Approach

Lightweight method for representing alternatives

- Softgoal model structures decisions and alternatives

Capture stakeholder preferences

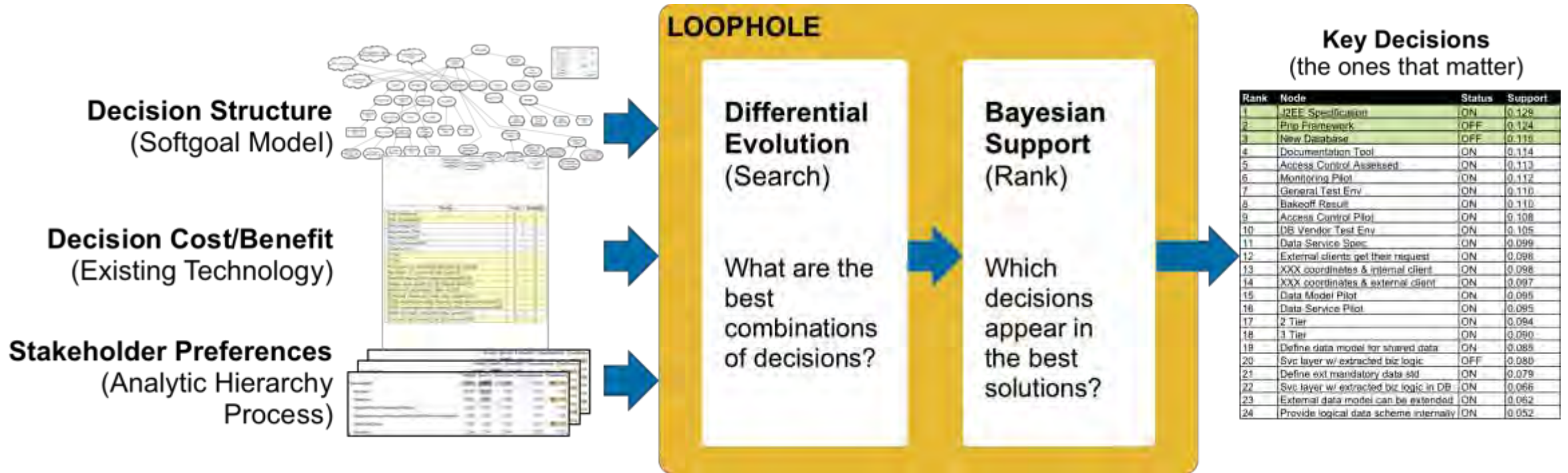
- Use Analytic Hierarchy Process (AHP)
  - Sequence of pairwise comparisons to rank criteria
  - Sequence of pairwise comparisons to rank how alternatives satisfy a criterion

Identify key decisions – given preferences, cost, benefit, risk, etc., which decisions most affect the outcome?

- Collaboration with North Carolina State University (Dr. Tim Menzies and George Mathew)
- LOOPHOLE Tool - Search-based approach (differential evolution) + Bayesian ranking

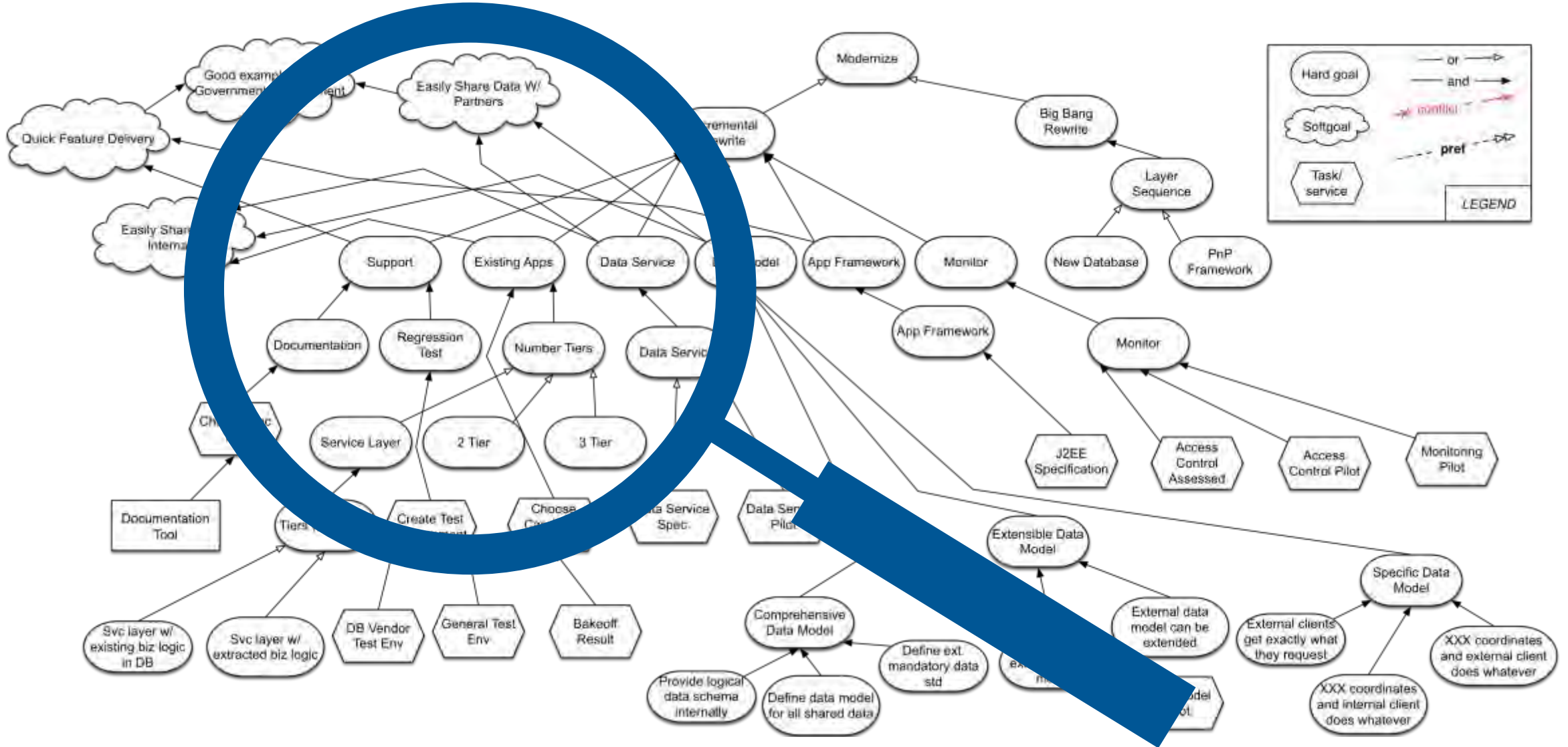


# Approach



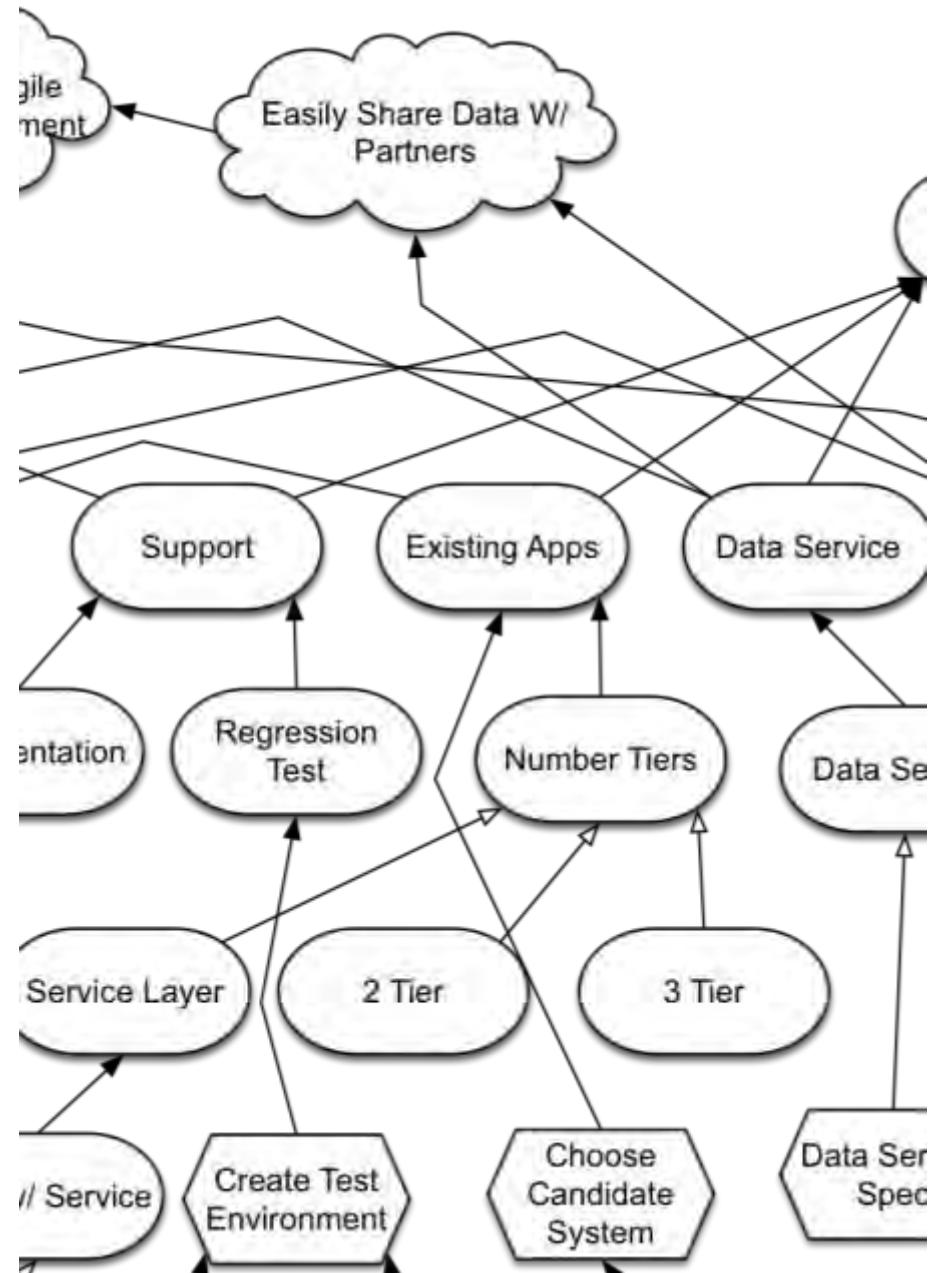
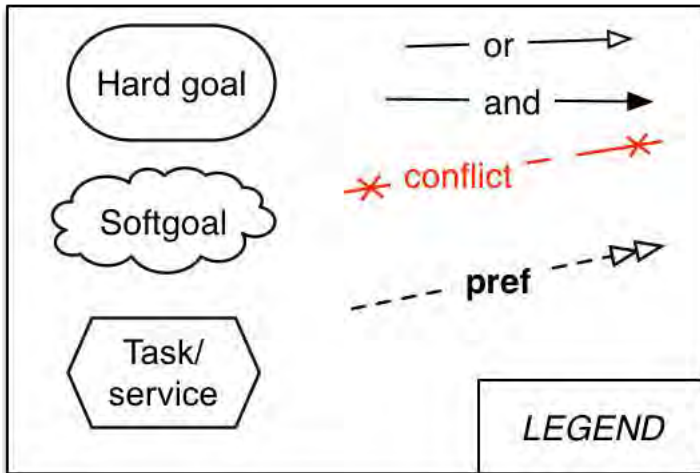


# Softgoal Model (Detail)

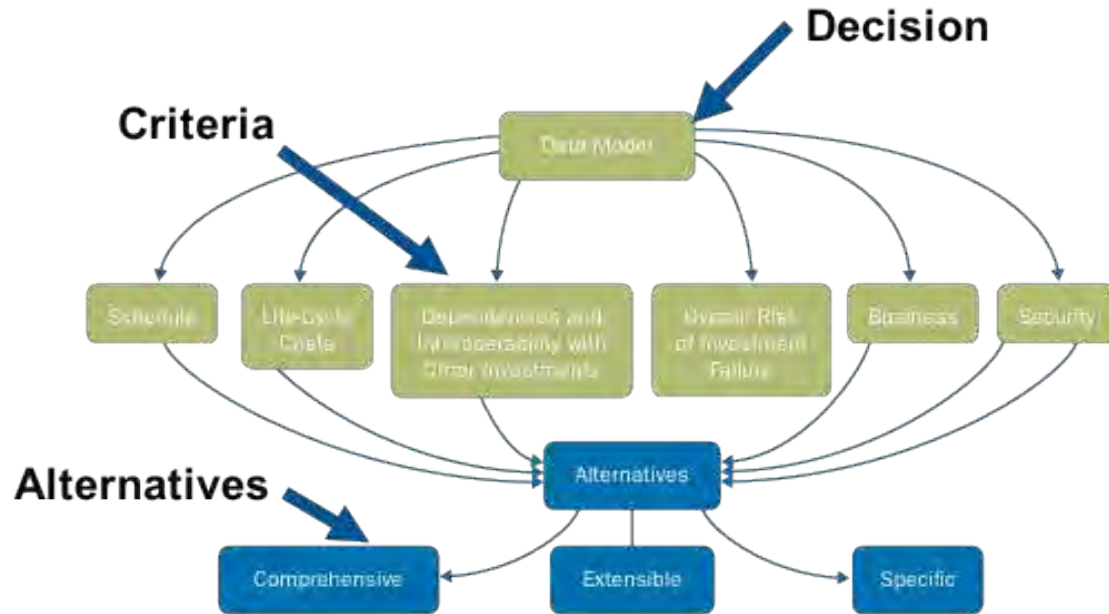




# Softgoal Model (Detail)



# AHP – Example Hierarchy and Pairwise Comparison Form



**Decision Name: Data Model?**

**Description:** What type of data model should we develop?

**Alternatives:** Comprehensive  
Extensible  
Specific

**Criterion: Schedule**

Comprehensive	is significantly worse than (-7)	Extensible
Comprehensive	is significantly worse than (-7)	Specific
Extensible	is a little worse than (-3)	Specific

**Criterion: Life-Cycle Costs**

Comprehensive	is significantly worse than (-7)	Extensible
Comprehensive	is significantly worse than (-7)	Specific
Extensible	is somewhat worse than (-5)	Specific



(repeat for all criteria)

# AHP Example – One Stakeholder's Preferences

**Alternatives**

↓

Preference Ranking →

	Weight	Specific	Extensible	Comprehensive	Consistency
<b>Data Model?</b>	100.0%	63.2%	27.4%	9.4%	⚠ 37.0%
Business	35.3%	26.4%	4.7%	4.2%	1.1%
Schedule	30.6%	19.3%	9.3%	1.9%	⚠ 11.7%
Overall Risk of Investment Failure	12.6%	5.7%	5.7%	1.1%	0.0%
Dependencies and Interoperability with Other Investments	9.9%	4.6%	4.6%	0.7%	0.0%
Life-Cycle Costs	8.8%	6.2%	2.1%	0.5%	⚠ 25.4%
Security	2.8%	0.9%	0.9%	0.9%	0.0%

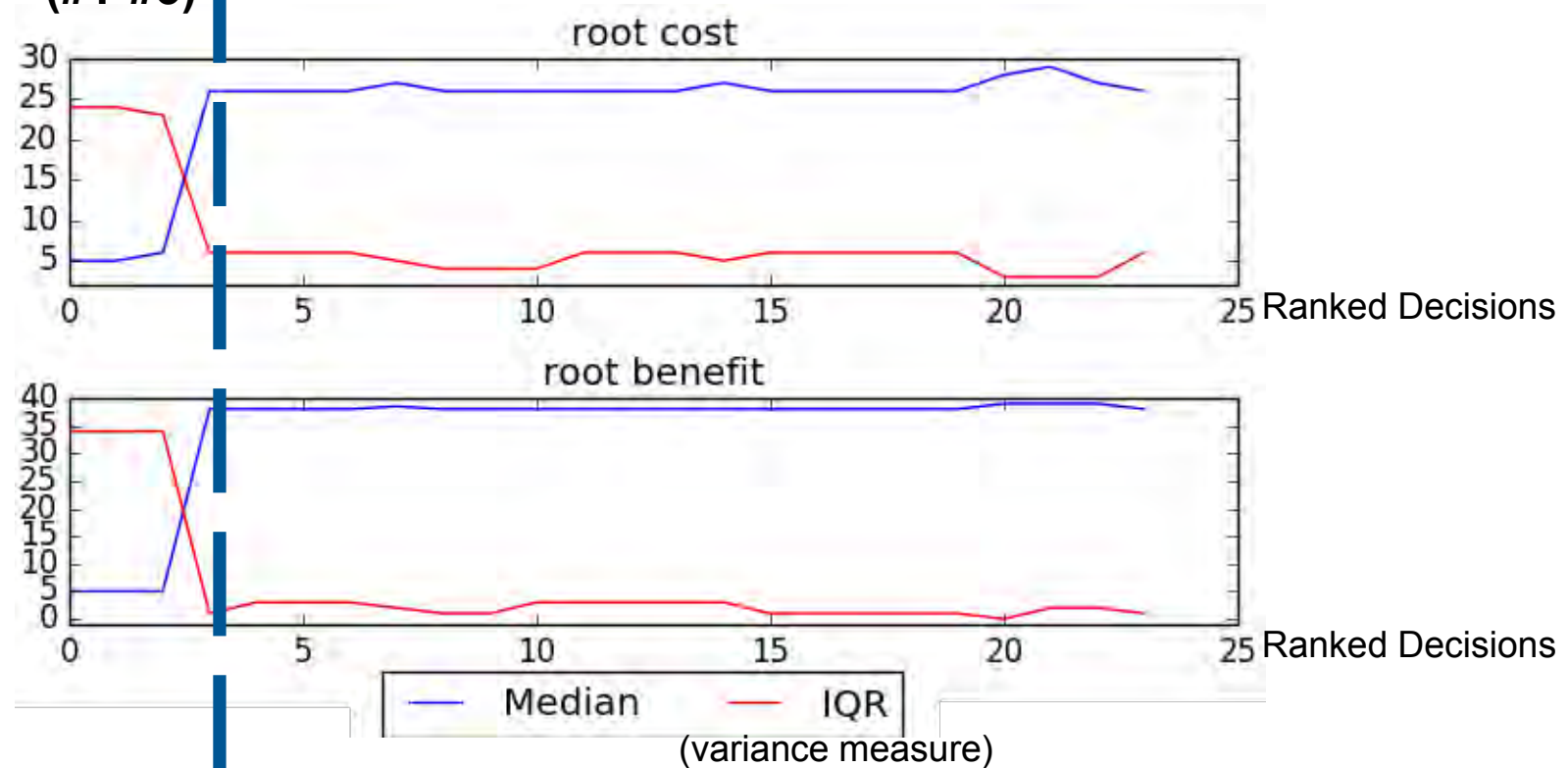
Criteria

Transitive Consistency of Pairwise Comparisons

# LOOPHOLE – Results

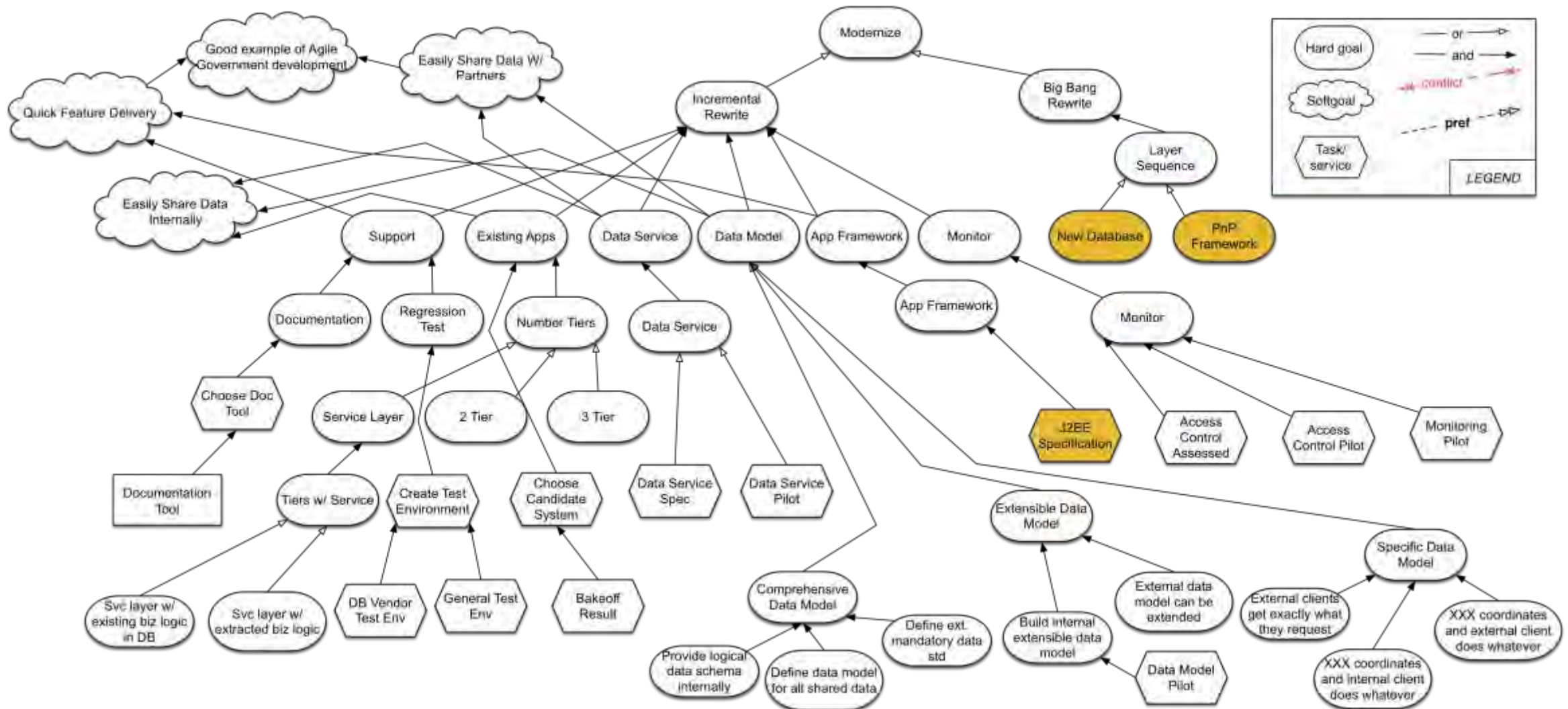
**Key  
Decisions  
(#1-#3)**

**After the Key Decisions are set, these  
decisions do not affect cost/benefit**





# Key Decisions Are Not Readily Identified from the Model Structure





# LOOPHOLE – Performance and Scalability

Model	Nodes	Edges	Runtime (sec)
CSServices	351	510	320
CSFDandMarketing	326	422	252
CSCounselling	350	470	240
CounsellingMgmt	206	239	62
CSITDepartment	126	162	28
CSSAProgram	114	168	27
KidsAndYouth	81	81	11
AOWS	53	57	10

Other larger models

Softgoal model example

Able to support real time  
collaborative decision making

# Future Work

Pilot application in an ongoing modernization project

Investigate sensitivity/interpretation of stakeholder ranking consistency

Explore preference mapping across the stakeholders to promote consensus-building

# Contact Information

## Principal Investigator:

John Klein

Senior Member of the Technical Staff

Telephone: +1 617.283.2170

Email: [jklein@sei.cmu.edu](mailto:jklein@sei.cmu.edu)

## Research Team:

Dr. Neil Ernst (SEI)

Dr. Tim Menzies (NC State University)

George Mathew (NC State University)