RT-137: Ilities Tradespace and Affordability Resource Analysis Based on System Architecture Behavior

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BEHAVIOR MODELING

NPS

Research Task / Overview

This aspect of the RT-137 task leverages the following innovations of Monterey Phoenix Behavior Modeling**:**

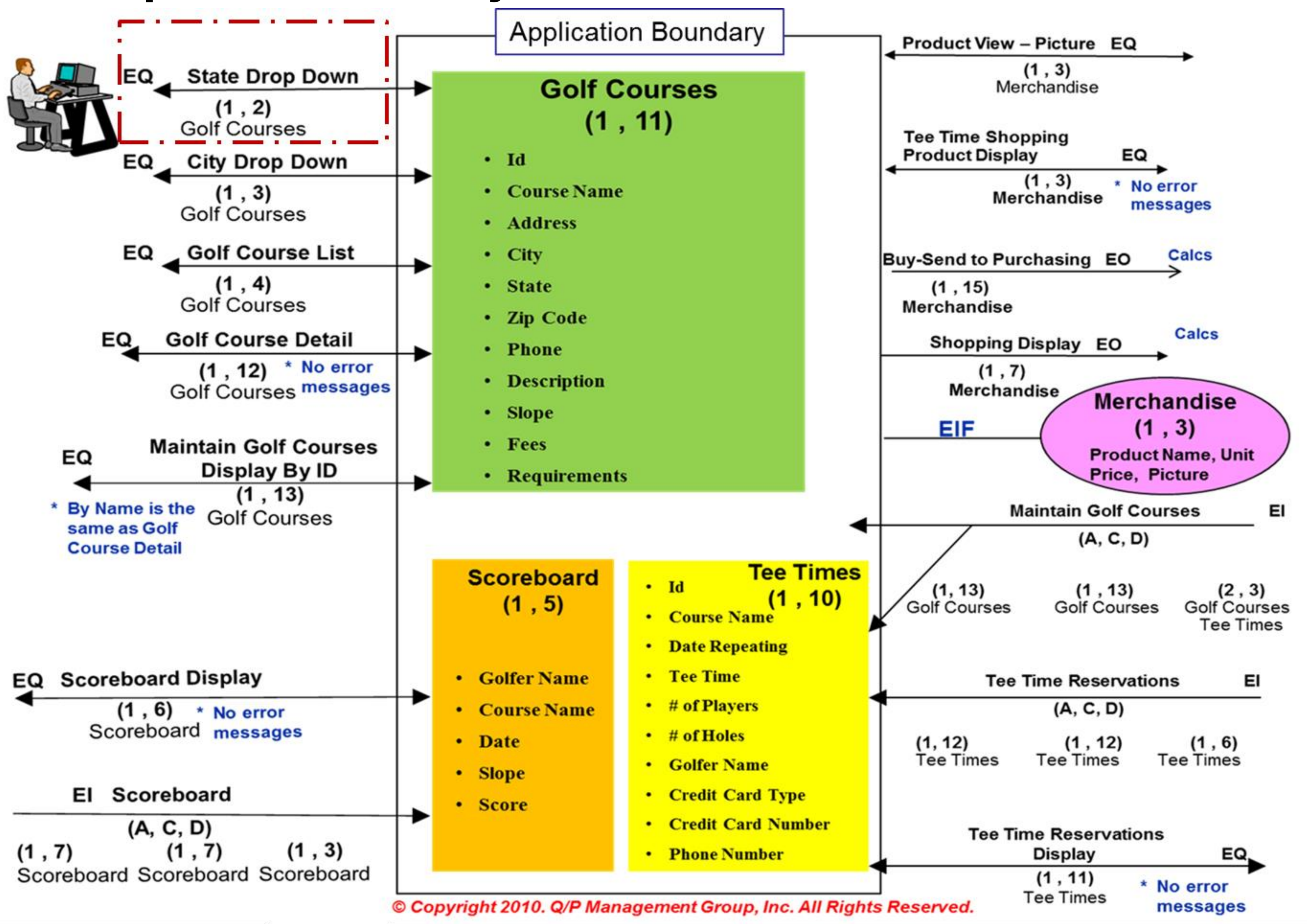
- Behaviors and interactions of the system AND environment are described in **one uniform framework**
- **System interactions** *among* components are **specified separately from system behaviors** *of* components
- A **library of all possible scenarios** (up to a specified scope limit) are generated from the separately specified behaviors and interactions, leveraging the **small scope hypothesis** that most flaws will be demonstrated on small counterexamples

Goals & Objectives

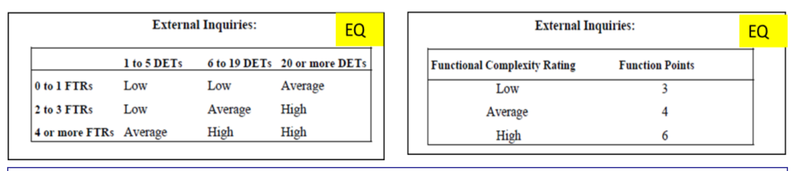
- To enable **affordability tradeoffs** with **integrated software-hardware-human factors** through Total Ownership Cost (TOC) modeling
  - Integrated costing of systems across **full lifecycle** operations
  - Extensions and consolidations for DoD application domains
  - Tool interoperability and tailorability (service-oriented)
- To leverage **Monterey Phoenix (MP)**, a system and software architecture and workflow modeling framework based on **behavior modeling**.
- To **improve affordability-related decisions** across all joint services
- To assess MP for **automatically providing cost information** from architectural models

Data & Analysis

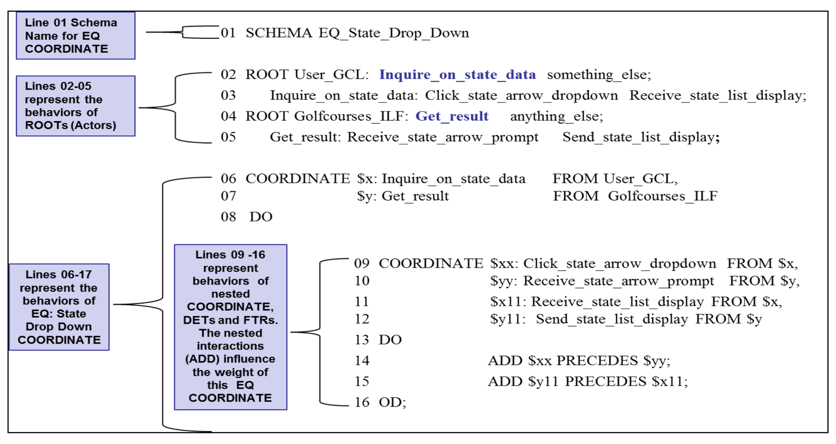
Example: Tee Time System



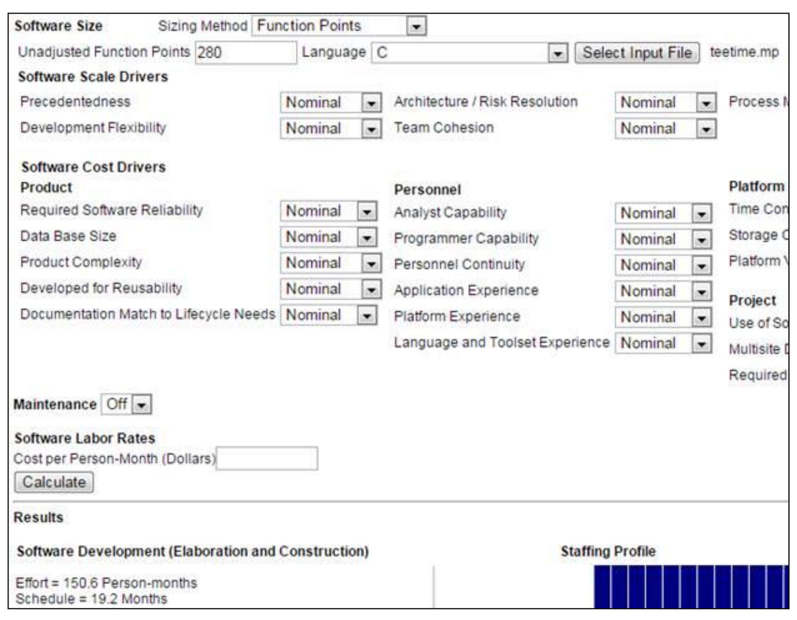
EP	Description	ILF/EIF	FTR / DET	Complex	UFP
EQ	State Drop Down	Golf Courses (I)	(1,2)	Low	3

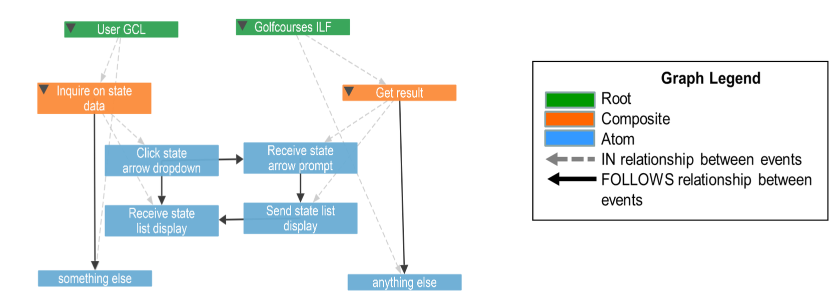


UFP Calculation: FPA Manual Count
1 FTR and 2 DETs identified from the behavior of the State Drop Down EQ
0-1 FTRs and 1-5 DETs correspond to a Low functional complexity rating
A Low functional complexity rating corresponds to 3 UFPs



UFP Calculation: Extracted From MP
•1 COORDINATE interaction associated with State Drop Down EQ behaviors
•State Drop down EQ COORDINATE contains a nested COORDINATE (2 ADDs)
•The 2 ADDs relate to 2 DETs
•ROOT Golfcourses_ILF relates to 1 FTR
•0 -1 FTRs and 1-5 DETs correspond to a Low functional complexity rating
•A Low functional complexity rating corresponds to 3 UFP
•EQ State Drop Down is equal to 1 COORDINATE with a weight of 3 or 3 UFPs

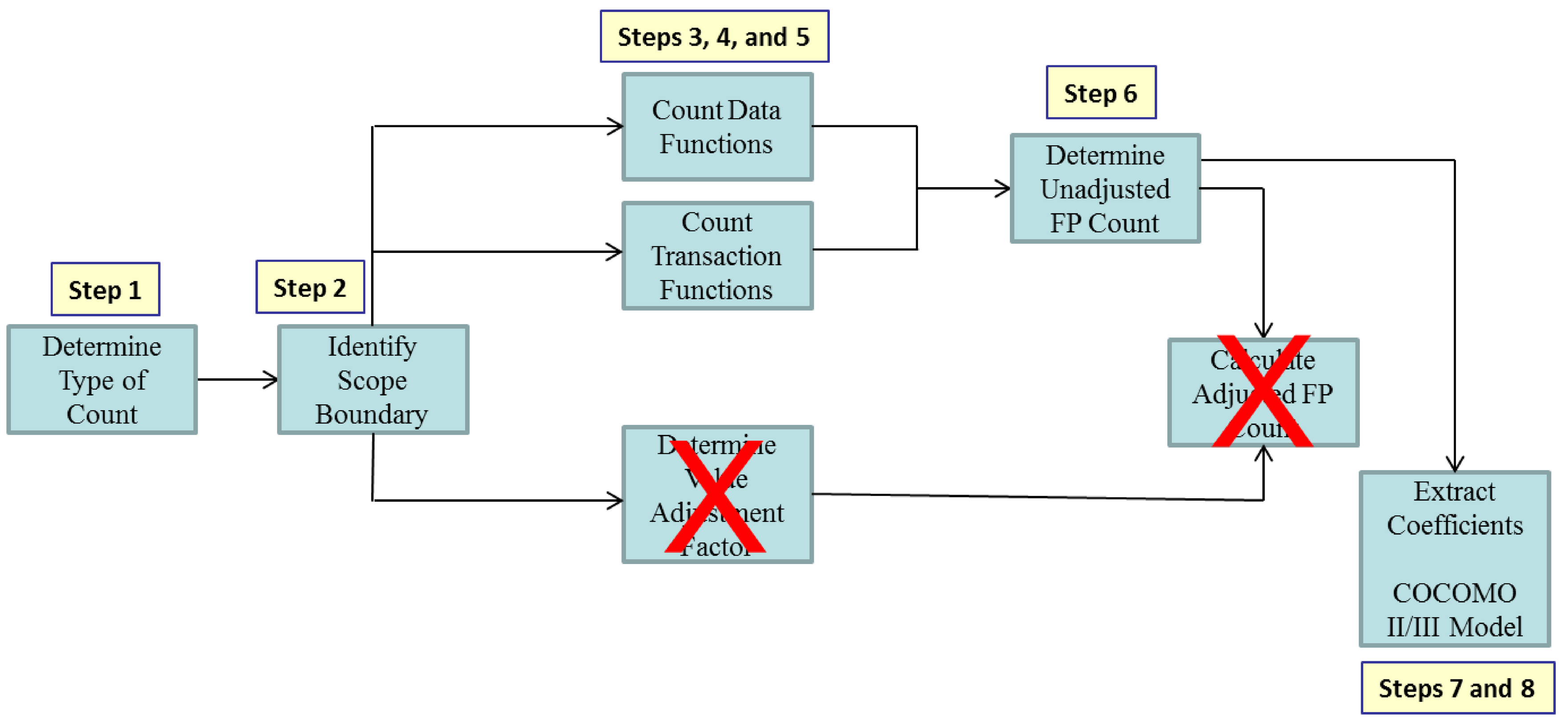




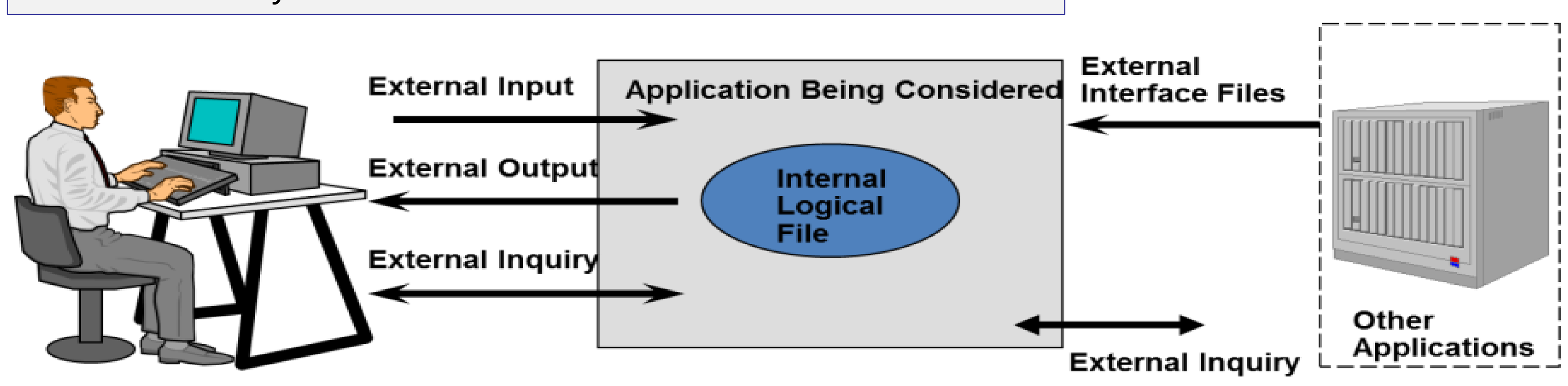
- The MP architecture model is based on behavior modeling, providing a bridge between the requirements and high level design.
- MP as a **formal architecture model** is a source for **cost estimate** information early in the **design phase**.
- The concept of an **event** in MP is an abstraction for activity within the system. It is **rendered as a pseudo-code**, appropriate for capturing the functional aspects of requirements, and supportive of refinement.
- **UFP** can be identified in the MP architecture model as an **interaction** abstraction (i.e. **COORDINATE or SHARE ALL** constructs).
- The structure and the complexity of interactions in MP provide a source for assigning weights contributing to the UFP.
- Since an MP model is precise and formal, FP **metrics** can be identified by **automated tools**.

Methodology

Apply Function Point (FP) Counting Methodology to Monterey Phoenix (MP) Behavioral Model:
- Identify typical questions to be answered and determine type of count
- Describe system and environment behaviors using MP, and extract Unadjusted FP from the model
- Assess effort using MP-COCOMO II tool, and visualize results in views specific to stakeholders



Unadjusted Function Point (UFP) is a unit of measurement to express the amount of functionality in a system, and can be used to estimate system cost. Of specific interest are the *input/output activities* of the system.



Terminology:
- External Inputs (EI): Data that is entering a system
- External Outputs (EO) and External Inquiries (EQ): Data that is leaving the system
- Internal Logical Files (ILF): Data that is processed and stored within the system
- External Interface Files (EIF): Data that is maintained outside the system but is necessary to satisfy a particular process requirement

Sources: IFPUG

Future Research

- Refine weights for each Transactional Function
- Refine relationship between steps of a FP Analysis Elementary Process and MP descriptions
  - Nested COORDINATES
  - ILF and EIF behavioral representations in MP
- Apply methodology to iTAP UAV case study and IFPUG case study

Contacts/References

- Monterey Phoenix and Related Work: http://faculty.nps.edu/maugusto
- MP Wiki (including full bibliography): https://wiki.nps.edu/display/MP
- Public MP server with MP editor, trace generator, and trace graph visualization: http://firebird.nps.edu/
- MP COCOMO Tool: http://csse.usc.edu/tools/MP_COCOMO