Developing Performance Engineering Core Competency

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Abstract

This paper describes the skill-sets and core competencies required to create a Performance Engineering practice designed to ensure the performance of enterprise applications and information technology infrastructures.

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Introduction to HyPerformix

HyPerformix offers enterprise performance solutions to Global 2000 companies, enabling them to predict, optimize and validate end-to-end performance of mission-critical, enterprise applications and information technology (IT) infrastructures. HyPerformix' enterprise approach to performance management combines leading-edge predictive modeling and data analysis software technology, extensive performance-engineering expertise, and a proven performance-assurance methodology. Specifically, we enable our customers to predict enterprise-wide performance, optimize existing IT infrastructures for improved return on investment, and validate mission-critical systems before and after deployment.

Introduction to Performance Engineering

HyPerformix technology applies proven engineering principals to the IT environment, this is called performance engineering. Performance engineering has long been used in many industries from semiconductors, computer components, and aircraft design. In the past, IT environments relied on the 'checkbook' approach to performance – adding more hardware every time a performance issue was encountered. This has proven to be a failed approach as the majority of IT performance problems occurred in applications. More and more IT organizations recognize the need to be proactive about managing the performance of their IT environments in order to reduce the costs of deploying enterprise applications and IT infrastructures, as well as ensuring their performance success. This need led HyPerformix to offer *Performance Innovation*, an offering designed to assist companies with establishing performance engineering practices.

Performance Innovation creates internal competencies, disciplines, processes, and best practices used in the delivery of proactive solutions that ensure performance success. HyPerformix offers *Performance Innovation* utilizing the HyPerformix Integrated Performance Suite™; software technology used throughout the performance engineering process. *Performance Innovation* can start small and grow over time, using a combination of HyPerformix and client resources, or HyPerformix can provide the majority of resources in an outsourcing role.

Competency Development

There are a number of ways to develop the required skill sets to achieve a core competency in performance engineering, the primary methods include:

- Formal education
- Hands-on experience
- Performance engineering project reviews to see how the techniques are applied
- Ongoing study of publications on these technologies (e.g., textbooks, industry organizations, etc.)

Certification

HyPerformix has a number of clients focused on developing core competencies in performance engineering. In order to measure their progress, HyPerformix has defined a set of achievement levels for each of the required competencies.

The competency level definitions provide the basis for a periodic skills analysis, which will:

- Identify the target and current achievement levels
- Propose a development plan of tasks and activities required to reach the target achievement level

Competency Definitions

This section defines the key elements required to build a performance engineering competency.

Performance Engineering (PE) Project Design

PE Project Design includes the skills required to deliver a performance engineering project from inception through completion. The focus is on project setup, delivery, and wrap-up. Mastering PE Project Design will enable a performance engineer to design and lead a PE project, where they are responsible and accountable for the success of the entire project.

PE Project Design responsibilities:

- Project scoping (estimates level of effort and duration)
- Developing an approach for the project
- Clearly identifying the goals/objectives of the project and the specific performance questions to be answered
- Determines the data required to support the goals of the project and the tools required to support data collection
- Determines the requirements for the modeling tasks
- Formulates modeling scenarios to answer the project's performance questions
- Writes the Project Plan
- Manages the delivery of the project
- Coordinates activities with team members and "customers"
- Writes the project's Final Report

Data Collection

The Data Collection competency addresses the skills required to effectively and efficiently collect the data required to support the goals of a PE project. The goal is to be able to independently develop and execute a data collection plan that satisfies the data requirements for a PE project.

Data Collection responsibilities:

- Design and develop a data collection plan
- Apply the data collection methodology
- Create an Application Parameter Set (APS) from the Application Characterization Data Model (ACDM)
- Execute a data collection plan
- Utilize measurement tools to collect the data specified in the data collection plan
- Utilize load testing tools to drive a test system during the data collection phase of a project

Data Analysis

Data Analysis addresses the skills required to analyze the data collected during data collection. The goal is to be able to analyze the collected data, verify the validity, populate an APS, and write a Data Analysis Report describing the results of the analysis.

Data Analysis responsibilities:

- Use analysis tools to shape collected data into a form suitable for analysis
- Develop ad-hoc analysis tools
- Analyze collected data to determine its validity
- Understand measurement metrics and their relationship to one another
- Prepare collected data for use by the model (populate the model's APS)
- Write the data analysis report

Model Development

The Model Development competency addresses the skills required to construct a performance model. The initial focus is on building models that can be used in a project. Higher skill levels address the need to develop reusable models and modeling components that can be used by the PE team.

Model Development responsibilities:

- Design a model
- Determine the proper level of abstraction required for model components (high-level versus detailed)
- Instrument the model to generate results that address the project's performance questions
- Use development techniques that improve the organization, readability, and comprehensibility of the model
- Recognition of modeling idioms that can be packaged and reused in other PE projects
- Use of techniques that assist with the verification of the model with the project sponsor

Scenario Analysis

Scenario Analysis addresses the skills required to utilize a model to answer the project's performance questions. The focus is on being able to develop, execute, and analyze scenario results.

Scenario Analysis responsibilities:

- Design and develop modeling scenarios
- Run a modeling scenario
- Analyze scenario results to determine success or failure
- Utilize scenario results to answer the project's performance questions
- Write the model results report

Reuse of Tools & Processes

The Reuse competency addresses the need to leverage tools and processes within the PE team and across PE projects. Examples of tools are data analysis scripts, modeling components, project document templates, etc. The goal is to have a well-stocked "bag of tricks" that can be effectively applied in future PE projects.

Reuse responsibilities:

- Design and develop tools for personal reuse
- Package tools so that they can be reused by others
- Recognize reusable project processes

Competency Levels and Objectives

The following table describes the achievement levels for each of the six competency categories and the five achievement levels, from beginner to expert. Level 1 represents someone just getting started, and Level 5 applies to someone who can perform the task independently and applies “Best Practices”.

Competency	Level 1	Level 2	Level 3	Level 4	Level 5
PE Project Design	No project design experience	Participates in PE project design	Contributes to PE project design"	Designs PE project independently	Leads & designs PE projects
Data Collection	No data collection experience	Assists with execution of a Data Collection Plan	Executes a Data Collection Plan with assistance	Executes a Data Collection Plan independently	Independently develops & executes a Data Collection Plan
Data Analysis	No data analysis experience	Assists with data analysis	Analyzes data with assistance	Independently analyzes data & contributes to the Data Analysis Report	Analyzes data & writes the Data Analysis Report independently
Model Development	No modeling experience	Modifies models with supervision	Builds models with assistance	Independently builds models using "Best Practices"	Independently builds reusable models & components using "Best Practices"
Scenario Analysis	No scenario skills	Runs scenarios	Runs scenarios & analyzes results	Designs & runs scenarios, analyzes scenario results	Independently designs, runs & analyzes scenarios, writes Model Results Report
Reuse of Tools & Processes	No reuse	Reuse tools personally developed	Reuse tools developed personally & some developed by others	Reuse tools across the group	Leverages all reusable tools; has a well organized library of configuration managed tools & components

Competency Progression

Each competency area has a skills development and mastery progression associated with it as defined below.

PE Project Design: Competency progresses from participating in the design of a project (an observer), to being a contributor (active involvement), to assuming responsibility for certain project design tasks (increased responsibility), to actually designing and leading a project (responsible and accountable for the success of the project).

Data Collection: Competency progresses from helping with specific data collection tasks, to performing certain tasks with assistance, to executing the Data Collection Plan independently and finally to being able to develop and execute a Data Collection Plan.

Data Analysis: Competency progresses from helping with data analysis tasks, to performing the analysis with some assistance, to independently being able to analyze a set of collected data, to being able to independently perform all data analysis tasks and write the Data Analysis Report.

Model Development: Competency progresses from making minor changes to a model with supervision, to building a model with assistance, to building a model without assistance, to creating reusable models and modeling components.

Scenario Analysis: Competency progresses from running a scenario, to analyzing scenario results, to designing scenarios, to independently performing all scenario tasks and documenting the results in the Model Results Report.

Reuse of Tools & Processes: Competency progresses from reusing tools developed personally, to reusing some tools reused by other, to general reuse within the PE group, and finally to a library of reusable tools and processes.

Competency Development Plans

This section contains recommendations for increasing the competency level for each of the core PE competencies. Suggested *learning activities* are listed for each level.

- In order to progress to the next level, each progressive level requires that the activities of the previous level have been completed. For example, the progression is from Level 2, to Level 3, and so on.
- It is assumed that a different project is used as you progress up a level in a particular competency. For example, it would not make sense to "execute a Data Collection Plan with assistance" and then "write the same Data Collection Plan", this time independently.

PE Project Design

Level 2 – Objective: Participates in PE project design

Learning Activities (to progress from Level 1 to Level 2):

- Attend the HyPerformix Performance Modeling Class
- Attend the HyPerformix Integrated Performance Suite (IPS) Class
- Attend and observe *all* project planning sessions
- Attend reviews of the data collection plan
- Attend reviews of the project plan
- Attend reviews of the data collection and analysis results
- Attend model reviews
- Attend validation results review
- Attend scenario results review
- Attend final presentation
- Attend project review at close of project ("Lessons Learned" session)

Level 3 – Objective: Contributes to PE project design

Learning Activities (to progress from Level 2 to Level 3):

- Perform Level 2 activities on a prior project
- Achieve Level 3 in data collection, data analysis and modeling
- Actively participate in the project planning process
- Write selected portions of the project plan and results presentation

Level 4 – Objective: Designs PE projects

Learning Activities (to progress from Level 3 to Level 4):

- Perform Level 3 activities on a prior project

- Design the approach for a project
- Write the project plan for a project (with assistance)

Level 5 – Objective: Leads and designs PE projects

Learning Activities (to progress from Level 4 to Level 5):

- Perform Level 4 activities on a prior project
- Write the project plan for a project (independently)

Data Collection

Level 2 – Objective: Assists with data collection plan execution

Learning Activities (to progress from Level 1 to Level 2):

- Attend the HyPerformix performance modeling class
- Attend the HyPerformix performance data collection class
- Observe the data collection process
- Assist with the execution of portions of a data collection plan (with supervision)
- Attend the data collection review

Level 3 – Objective: Executes data collection plan with assistance

Learning Activities (to progress from Level 2 to Level 3):

- Perform Level 2 activities on a prior project
- Execute a Data Collection Plan with assistance from the Performance Engineering Consultant (PEC)

Level 4 – Objective: Executes data collection plan independently

Learning Activities (to progress from Level 3 to Level 4):

- Perform Level 3 activities on a prior project
- Execute a data collection plan (independently)
- Review with the PEC and discuss questions/issues

Level 5 – Objective: Independently analyze data and write the data analysis report

Learning Activities (to progress from Level 4 to Level 5):

- Perform Level 4 activities on a prior project
- Develop a data collection plan
- Review the data collection plan with the PEC
- Execute the data collection plan (independently)

Data Analysis

Level 2 – Objective: Assists with data analysis

Learning Activities (to progress from Level 1 to Level 2):

- Attend the HyPerformix performance modeling class
- Attend the HyPerformix performance data collection class
- Attend and observe the data collection planning session (at a minimum; if possible attend all Planning sessions)
- Observe the data collection process
- Attend the data analysis review
- Discuss the review with the PEC who performed the Analysis

Level 3 – Objective: Analyzes data with assistance

Learning Activities (to progress from Level 2 to Level 3):

- Perform Level 2 activities on a prior project
- Experience with analysis tools (e.g. SAS or spreadsheet analysis) is required
- Actively participate in portions of the Data Analysis
- Review with the PEC

Level 4 – Objective: Analyzes data independently and contributes to the data analysis report

Learning Activities (to progress from Level 3 to Level 4):

- Perform Level 3 activities on a prior project
- Perform the data Analysis for a project
- Work with the PEC to develop the data analysis report, contributing to portions of it

Level 5 – Objective: Independently analyzes data and writes the data analysis report

Learning Activities (to progress from Level 4 to Level 5):

- Perform Level 4 activities on a prior project
- Prepare a data analysis report (independently)

Model Development

Level 2 – Objective: Modifies models with supervision

Learning Activities (to progress from Level 1 to Level 2):

- Attend the HyPerformix performance modeling class

- Attend the HyPerformix IPS Class
- Attend and observe *all* project planning sessions
- Attend model reviews
- Attend validation results review
- Review model's Application Design Notation (AND) code with the PEC
- Make minimal changes to the model with assistance from the PEC

Level 3 – Objective: Builds models with assistance

Learning Activities (to progress from Level 2 to Level 3):

- Perform Level 2 activities on a prior project
- Build a model with assistance from the PEC
- Make changes to a model independently
- Assist with the preparation of the model review

Level 4 – Objective: Independently builds models using best practices

Learning Activities (to progress from Level 3 to Level 4):

- Perform Level 3 activities on a prior project
- Build a model independently
- Review with PEC to evaluate usage of Best Practices
- Prepare the Model Review (independently)
- Assist with the Model Validation effort

Level 5 – Objective: Independently builds reusable models and components using best practices

Learning Activities (to progress from Level 4 to Level 5):

- Perform Level 4 activities on a prior project
- Build a model independently, using Best Practices
- Review the model with the PEC, evaluating its reusability
- Perform model validation (independently)
- Prepare the model validation review (independently)

Scenario Analysis

Level 2 – Objective: Runs Scenarios

Learning Activities (to progress from Level 1 to Level 2):

- Attend the HyPerformix performance modeling class
- Attend the HyPerformix IPS class
- Attend and observe *all* project planning sessions

- Attend model reviews
- Run model scenarios (with supervision of the PEC)

Level 3 – Objective: Runs and analyzes scenario results

Learning Activities (to progress from Level 2 to Level 3):

- Perform Level 2 activities on a prior project
- Assist with the design of model scenarios
- Run scenarios independently
- Analyze scenario results independently
- Review analysis and results with PEC

Level 4 – Objective: Designs, runs and analyzes scenario results

Learning Activities (to progress from Level 3 to Level 4):

- Perform Level 3 activities on a prior project
- Design model scenarios
- Review model scenarios with the PEC
- Run scenarios independently
- Analyze scenario results independently
- Assist with the preparation of the scenario results review

Level 5 – Objective: Independently designs, runs, analyzes, and writes the scenario results report

Learning Activities (to progress from Level 4 to Level 5):

- Perform Level 4 activities on a prior project
- Design a scenario plan (independently)
- Execute the scenario plan (independently)
- Analyze scenario results (independently)
- Prepare the scenario analysis report (independently)

Reuse of Tools & Processes

Level 2 – Objective: Reuse personal tools

Learning Activities (to progress from Level 1 to Level 2):

- Develop scripts, Profiler tools and models for analysis
- Use tools on a subsequent project
- Define processes for using tools

Level 3 – Objective: Reuse personal tools and others

Learning Activities (to progress from Level 2 to Level 3):

- Perform Level 2 activities
- Develop standards for tools and process documentation
- Document tools and processes
- Create common repository for tool and process storage
- Track effectiveness of tools and processes

Level 4 – Objective: Reuse tools across the PE group

Learning Activities (to progress from Level 3 to Level 4):

- Performa Level 3 activities
- Provide access to repository of tools and processes to the entire performance and capacity planning functions
- Update and maintain repository with most effective tools and processes
- Track tool usage and gather new requirements

Level 5 – Objective: Reuse tool library

Learning Activities (to progress from Level 4 to Level 5):

- Perform Level 4 activities
- Productize the tools and processes
- Publish tools and processes to other organizations
- Provide quality assurance and technical support for the tool library

Conclusion

The performance engineering competency development methodology discussed in this document provides the framework for implementing a performance engineering practice. When combined with performance engineering technology delivered through the HyPerformix Integrated Performance Suite™ and performance engineering services delivered through HyPerformix's *Performance Innovation* practice, clients are capable of delivering proactive solutions that ensure the performance success of their enterprise applications and IT infrastructures.


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