Performance Management Service Level and Activities Calculator [1]

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This paper describes the development of a "calculator" that can be used to provide an initial view of the optimum set of activities to manage the performance of an application. The calculator shows Performance Management service levels, activities, and roles for the full software development lifecycle (SDLC).

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1. Introduction

This paper describes the development of a "calculator" that can be used to provide a quick initial view of the optimum set of activities to manage the performance of an application. The original idea was the development of Performance Management processes and a supporting calculator, with definition of roles and responsibilities for Operations, Engineering, Network Services, Engineering, Program Office, and Development. The products were:

- Definition of Performance Management and the SDLC-based Performance Management life cycle
- Characterizations of three Performance Management areas: Performance Engineering (PE), Capacity Planning (CP), and Performance Operations (PO)
- Development of the following for the three Performance Management areas across the SDLC:
    - Service levels
    - Activities
    - Organizational roles and responsibilities
    - Integration points

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In testing, it was found that recommended activities were being done in the later life cycle stages, but there was a lack of emphasis on planning and budgeting and on requirements gathering for performance and capacity. This confirmed a lack of Performance Management activities early in the SDLC.

2. Performance Management Definition

Performance Management can be considered as a set of activities within Capacity Management, one of the processes found in the Service Design phase of the Information Technology Infrastructure Library (ITIL®) V3 service delivery lifecycle. Capacity Management's goal is to ensure that cost-justifiable capacity in all areas of IT always exists and is matched to the current and future agreed needs of the business, in a timely manner. Capacity Management is not a one-time design activity, but an ongoing process that looks at the entire IT environment throughout the service delivery lifecycle and has both proactive and reactive elements. Capacity Management also works with the ITIL® V3 Service Level Management process to ensure that service level targets for new services are reasonable considering capacity constraints.

Performance Management begins in the design of a new or changed service and includes planning of hardware, software, staffing, and processes to ensure successful deployment. Performance Management fits within the proactive element of Capacity Management by predicting future needs, developing capacity solutions, and engaging with service level management to ensure achievable performance targets.

Reactive elements of Performance Management occur post-deployment. They include monitoring and responding to threshold alerts, assisting the service desk in resolving incidents, and conducting capacity-related root cause analyses.

Performance Management begins with an understanding of business demands and performance targets, as well as current capacity, performance, and technology limitations. Only after methodical performance and capacity modeling has yielded capacity requirements should procurement of resources begin. This ensures that acquisitions are defendable, and it increases the likelihood of selecting the best solution considering total cost of ownership and scalability.

2.1 Performance Management Areas

The three Performance Management areas have the same concerns, but each has a different focus, so each has different activities. Together, the Performance Management areas focus on continuous evolution and improvement of systems. Each area informs the others, as shown in Figure 1.

Performance Engineering (PE)
- Focus: *Design*
- Given Service Levels
- Given Resources
- Given Workload

Capacity Planning (CP)
- Focus: *Resources*
- Given Design
- Given Service Levels
- Given Workload

Performance Operations (PO)
- Focus: *Service Levels*
- Given Design
- Given Resources
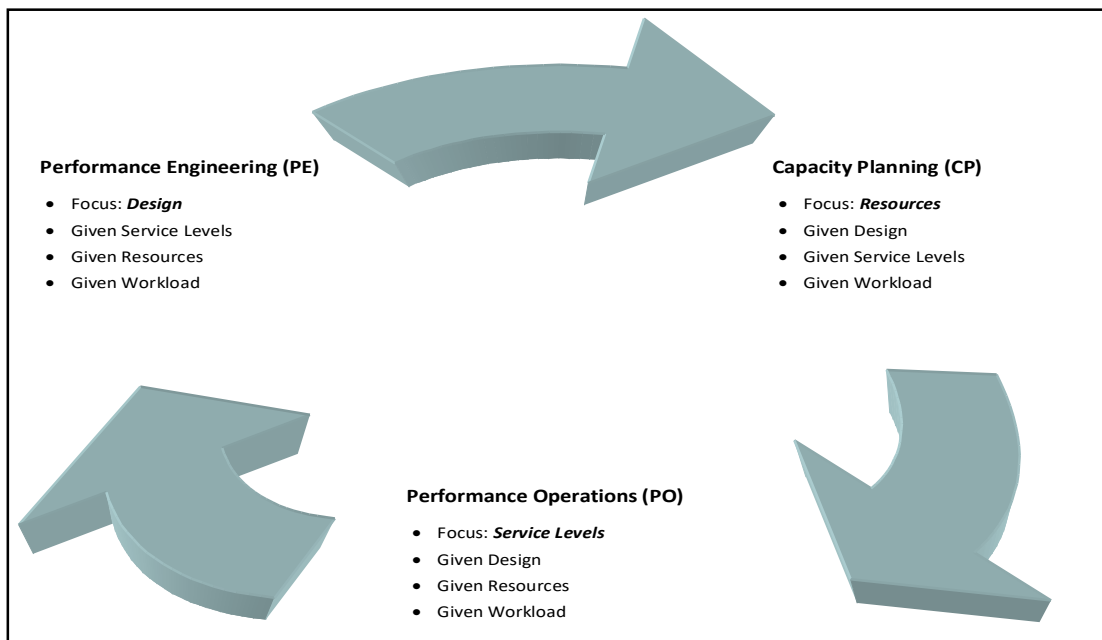- Given Workload

Figure 1: Performance Management Lifecycle

The three Performance Management areas are:

- Performance Engineering (PE) - The focus of Performance Engineering is to maximize performance in the design of an application, given defined service levels (e.g., availability, response time), system capacity (e.g.,

processor, memory, storage, network bandwidth), and workload size (e.g., transactions, users). Performance Engineering occurs in the early part of the lifecycle, concluding with the testing phase.

- Capacity Planning (CP) - The focus of Capacity Planning is to optimize system capacity (e.g., processor, memory, storage, network bandwidth), given the design of the application, defined service levels (e.g., availability, response time), and workload size (e.g., transactions, users). Capacity Planning efforts occur primarily in the middle part of the lifecycle, based on testing phase results.
- Performance Operations (PO) - The focus of Performance Operations is to manage the operational system (hardware, operating system, system software, application) to defined service levels (e.g., availability, response time), given the implemented system capacity (e.g., processor, memory, storage, network bandwidth), the design of the application, and workload size (e.g., transactions, users). Performance Operations efforts occur primarily in the latter part of the lifecycle, after application deployment.

3. Development of Performance Management Program

To support rapid decision making on which Performance Management activities should be conducted for applications, a standard program has been developed based on standard SDLC activities, lead organizations, scenarios for different categories of applications, service levels, and service level criteria.

3.1 Activities and Service Levels

The following steps can be used in developing a Performance Management program for an application:

- Assign appropriate organizational SDLC activities to each of the Performance Management areas.
- Assign a lead organization for each activity.
- Using the following definitions of major service levels, determine whether each activity should be performed based on the service level:
  - Gold (G) – top level of service
  - Silver (S) – average level of service
  - Bronze (B) – lowest level of service

Table 1 shows example activities, SDLC phases, minimum service levels, and lead organizations.

SDLC Phases are defined as:

- Phase 0 – Vision
- Phase 1 – Planning
- Phase 2 – Requirements
- Phase 3 – Design
- Phase 4 – Develop / Test
- Phase 5 – Deploy / O&M (Operations and Maintenance)

As examples:

- PE activity 3 should be done for all service levels (gold, silver, and bronze), because it is defined for the bronze (B) level
- PE activity 6 is only required for the gold (G) level
- CP activity 1 should be done for the silver and gold levels (S)

Table 1: Example Performance Management Activities, Service Levels, and Organizations

PE Activities	SDLC Phase	Service Level	Lead Organization
1 Define Business Needs	0	G	Project Office
2 Convert Business Needs to Performance Needs/Standards		S	Engineering
3 Tailor PE Activities for Project Plan	1	B	Engineering
4 Incorporate PE Activities into Project Plan		G	Project Office
5 Decompose Requirements into Detailed Performance Requirements	2	S	Engineering
6 Orchestrate Approval of Performance Requirements		G	Project Office
7 Develop/Update Design/Architecture (iterate with 8 and 10)	3	B	Develop
8 Analyze/Model/Simulate/Evaluate Design Performance (iterate with 7)		S	Engineering
9 Approve Design/Architecture for Performance		B	Engineering
10 Develop System to Approved Design (iterate with 7)	4	B	Develop
11 Develop Performance Testing Plan & Conduct Testing to Plan		S	Develop
12 Approve Performance Testing Results & Readiness for Deployment		S	Engineering
13 Approve System for Deployment and Deploy	5	G	Project Office

CP Activities	SDLC Phase	Service Level	Lead Organization
1 Convert Business, Performance, and Performance Operations Needs into System Capacity Standards/Estimates for Budget (iterate with 2)	0-1	S	Operations
2 Convert Business, Performance, and Performance Operations Needs into Network Capacity Standards/Estimates for Budget (iterate with 1)		S	Network Services
3 Refine System Capacity Estimates from Requirements(iterate with 4)	2	B	Operations
4 Refine Network Capacity Estimates from Requirements (iterate with 3)		B	Network Services
5 Model System Capacity from Architecture and Design; Order Equipment (iterate with 6 and 7)	3	S	Operations
6 Model Network Capacity from Architecture and Design; Order Equipment (iterate with 5 and 8)		S	Network Services
7 Develop Ongoing System Plan/Forecast based on Load Testing (iterate with 5 and 8)	4	G	Operations
8 Develop Ongoing Network Plan/Forecast based on Load Testing (iterate with 6 and 7)		G	Network Services
9 Finalize System Capacity Plan and Forecasts for System (iterate with 10)	5	B	Operations
10 Finalize Network Capacity Plan and Forecasts for System (iterate with 9)		B	Network Services

PO Activities	SDLC Phase	Service Level	Lead Organization
1 Define Business Needs	0	G	Project Office
2 Convert Business Needs to System PO Needs & Standards (iterate with 3)		S	Operations
3 Convert Business Needs to Network PO Needs & Standards (iterate with 2)		S	Network Services
4 Tailor System PO Activities for Project Plan (iterate with 5)	1	B	Operations
5 Tailor Network PO Activities for Project Plan (iterate with 4)		B	Network Services
6 Incorporate PO Activities into Project Plan		G	Project Office
7 Decompose Requirements into Detailed System PO Reqs (iterate with 8)	2	B	Operations
8 Decompose Requirements into Detailed Network PO Reqs (iterate with 7)		B	Network Services
9 Orchestrate Approval of PO Requirements		G	Project Office
10 Design System PO to Requirements	3	S	Develop
11 Design System PO Instrumentation to Requirements (iterate with 13)		S	Develop
12 Approve System PO Design		G	Project Office
13 Develop System PO Instrumentation (iterate with 11)	4	S	Develop
14 Develop System PO Instrumentation Test Plan and Conduct Testing		S	Develop
15 Approve System PO Testing Results		B	Project Office
16 Approve Network PO Operational Readiness	5	G	Network Services
17 Approve System PO and Deploy		B	Operations

3.2   Scenarios

Scenarios of different applications have been developed to show activities across the SDLC lifecycle for each Performance Management area. Table 2 shows sample scenario definitions, including initial evaluations of service levels.

Table 2: Scenario Definitions

SCENARIO	1. CRITICAL SYSTEM	2. MAJOR SYSTEM	3. NEW CUSTOMER FACING SYSTEM	4. INTERNALLY USED SYSTEM	5. DESKTOP SYSTEM
Expected Service Levels	PE – Gold CP – Gold PO - Gold	PE – Gold CP – Silver PO - Gold	PE – Gold CP – Silver PO - Silver	PE – Silver CP – Bronze PO - Bronze	PE – Bronze CP – Bronze PO - Bronze
Key System Characteristics	• Many interfaces • Many performance reqs • Large % change • Many tickets • Existing app • Several locations • Many Gigabytes (GB) replicated • Many users • Large % load change • Customer facing • Business critical • Performance monitored	• Many interfaces • Many performance reqs • Large % change • Many tickets • Existing app • Several locations • Many GB backed up • Some users • Some % load change • No customer use • Business critical • Performance monitored	• Some interfaces • Some performance reqs • 100% change • No tickets • New app • Few locations • Many GB backed up • Some users • 100% load change • Customer facing • Business important • Performance monitored	• Some interfaces • Some performance reqs • Some % change • Some tickets • Existing app • Few locations • Many GB backed up • Some users • Some % load change • No customer use • Not business critical • Errors monitored	• No interfaces • No performance reqs • Little % change • No tickets • Existing app • One location • Some GB backed up • Few users • Little % load change • No customer use • Not business critical • Errors monitored

4. Service Level and Activities Calculator

A spreadsheet has been developed (available on request) that implements the above defined Performance Management program. The following sections show the data entry and calculations in the calculator (specific instructions are in the spreadsheet). The overall process is shown in Figure 2.

Figure 2: Performance Management Calculator Process

The calculator uses entered application information and ratings against defined criteria to determine Performance Management service levels and activities for the application. Calculated activities can then be compared to the application's project plan to ensure the appropriate Performance Management activities are in the plan to cost effectively minimize risk of performance or capacity issues.

4.1 Criteria, Metrics, System Information, and Service Rating

Criteria to be used to determine service levels are defined for each of the Performance Management areas, along with service metrics for high (5), medium (3), or low (1) values. The spreadsheet criteria and activities can be customized for each organization's priorities.

System information is entered and ratings are entered based on the service metrics definitions. Table 3 shows example criteria for the three Performance Management area, along with entered system information and rating.

Table 3: Service Level Criteria and Metrics

Performance Engineering Criteria and Metrics Definitions				Service Metrics			App Info	Rating
#	Criteria Name	Criteria Definition	Criteria Justification	High (5)	Medium (3)	Low (1)		
1	Many/Complex Interfaces	Many or complex interfaces	Many and/or complex interfaces may need capacity planned more carefully	>4 interfaces and/or 1 complex interface	>=2-4 interfaces	<2 interfaces	1 complex interface	5
2	High WAN Use	Significant amount of WAN transmission	Extensive use of WAN to transmit data may need to be engineered and tested more extensively	>155 Mb/sec (OC3)	>=52-155 Mb/sec (OC1+)	<52 Mb/sec	OC1	3
3	Many Lines of Code	Multiple hardware platforms and/or locations	Multiple hardware platforms and/or locations may be more complex to manage	>500K SLOC	>=100-500K SLOC	<100K SLOC	200 SLOC	3
4	Many Performance Reqs	Shared infrastructure	Shared infrastructure may need capacity planned more carefully	>100 requirements	50-100 requirements	<50 requirements	120 requirements	5
5	Code Not Stable	Extensive disaster recovery	Extensive disaster recovery (DR) capabilities may need capacity planned more carefully	>25% changed	>=10-25% changed	<10% changed	11% code change	3
6	Prior Problem Tickets	Many users	Many users may need capacity planned more carefully	>50 unique errors / past year	>=25-50 unique errors / past year	<25 unique errors / past year	70 app errors	5
7	New System	Significant workload change	Significant workload change may need capacity planned more carefully	yes		no	existing app	5
8	Mainframe	Monitoring in place/planned	Monitoring capabilities implemented/planned, may have stringent performance requirements	mainframe	Linux	PC	Tier 2	3

	Capacity Planning Criteria and Metrics Definitions			Service Metrics			System Info	Rating
#	Criteria Name	Criteria Definition	Criteria Justification	High (5)	Medium (3)	Low (1)		
1	Many/Complex Interfaces	Many or complex interfaces	Many and/or complex interfaces may need capacity planned more carefully	>4 interfaces and/or 1 complex interface	>=2-4 system interfaces	<2 system interfaces	1 complex interface	5
2	High WAN Use	Significant amount of WAN transmission	Extensive use of WAN to transmit data may need to be engineered and tested more extensively	>155 Mb/sec (OC3)	>=52-155 Mb/sec (OC1+)	<52 Mb/sec	OC1	3
3	Multiple HW Platforms/ Locations	Multiple hardware platforms and/or locations	Multiple hardware platforms and/or locations may be more complex to manage	>2 HW platforms/locations	2 HW platforms/locations	1 HW platform/location	2 HW locations	3
4	Shared Infrastructure	Shared infrastructure	Shared infrastructure may need capacity planned more carefully	All components on shared infrastructure	Some components on shared infrastructure	No components on shared infrastructure	not shared	1
5	Disaster Recovery	Extensive disaster recovery	Extensive disaster recovery (DR) capabilities may need capacity planned more carefully	>=50 GB replicated	>=50 GB backed up	<50 GB replicated or backed up	70 GB backup	3
6	Large User Base	Many users	Many users may need capacity planned more carefully	>200 users	>=50-200 users	<50 users	20 users	1
7	Workload Stability	Significant workload change	Significant workload change may need capacity planned more carefully	>25% workload change	>=10-25% workload change	<10% workload change	5% workload change	1
8	Monitoring	Monitoring in place/planned	Monitoring capabilities implemented/planned, may have stringent performance requirements	Performance and error monitoring	Only error monitoring	No monitoring	no monitoring	1

	Performance Operations Criteria and Metrics Definitions			Service Metrics			System Info	Rating
#	Criteria Name	Criteria Definition	Criteria Justification	High (5)	Medium (3)	Low (1)		
1	Many/Complex Interfaces	Many or complex interfaces	Many and/or complex interfaces may need capacity planned more carefully	>4 interfaces and/or 1 complex interface	>=2-4 system interfaces	<2 system interfaces	1 complex interface	5
2	High WAN Use	Significant amount of WAN transmission	Extensive use of WAN to transmit data may need to be engineered and tested more extensively	>155 Mb/sec (OC3)	>=52-155 Mb/sec (OC1+)	<52 Mb/sec	OC1	3
3	Multiple HW Platforms/ Locations	Multiple hardware platforms and/or locations	Multiple hardware platforms and/or locations may be more complex to manage	>2 HW platforms/locations	2 HW platforms/locations	1 HW platform/location	2 HW locations	3
4	Shared Infrastructure	Shared infrastructure	Shared infrastructure may need capacity planned more carefully	All components on shared infrastructure	Some components on shared infrastructure	No components on shared infrastructure	not shared	1
5	Disaster Recovery	Extensive disaster recovery	Extensive disaster recovery (DR) capabilities may need capacity planned more carefully	>=50 GB replicated	>=50 GB backed up	<50 GB replicated or backed up	70 GB backup	3
6	Customer Facing	Many users	Many users may need capacity planned more carefully	Customer facing		Not customer facing	not customer facing	1
7	Workload Stability	Significant workload change	Significant workload change may need capacity planned more carefully	>25% workload change	>=10-25% workload change	<10% workload change	5% workload change	1
8	Monitoring	Monitoring in place/planned	Monitoring capabilities implemented/planned, may have stringent performance requirements	Performance and error monitoring	Only error monitoring	No monitoring	no monitoring	1

4.2   Service Level Calculation

The spreadsheet calculates service levels for each Performance Management area, based on the ratings shown in Table 3. Figure 3 shows the service level calculator results using the Table 3 ratings.

Criteria # Cross-Reference		1	2	3	4	5	6	7	8
System	PE Service	Many/Complex Interfaces	High WAN Use	Many Lines of Code	Many Performance Reqs	Code Not Stable	Prior Problem Tickets	New System	Mainframe
Sample System	● 32	5	3	3	5	3	5	5	3

Criteria # Cross-Reference		1	2	3	4	5	6	7	
System	CP Service	Many/Complex Interfaces	High WAN Use	Multiple HW Platforms/ Locations	Shared Infrastructure	Disaster Recovery	Large User Base	Workload Stability	
Sample System	△ 17	5	3	3	1	3	1	1	

Criteria # Cross-Reference		1	2	3	4	5	6	7	8
System	PO Service	Many/Complex Interfaces	High WAN Use	Multiple OS Platforms/ Locations	Shared Infrastructure	Disaster Recovery	Customer Facing	Business Critical	Monitoring
Sample System	◆ 13	1	3	2	1	3	1	1	1

Gold Service >	21	●
Silver Service >	14	△
Bronze Service >	0	◆

System	PE Service	CP Service	PO Service
Sample System	● 32	△ 17	◆ 13

Figure 3: Service Level Calculator Results

4.3   Activities for Service Levels

Detailed activities for each Performance Management area are defined by the spreadsheet based on calculated service levels. Table 4 shows some color-coded activities for PE, along with lead organizations, and associated SDLC artifacts. For the top service level (Gold), all activities are done (color-coded in gold, silver, and bronze). The Silver service level activities are color-coded in silver and bronze. The Bronze service level activities are in bronze. Only the first three SDLC phases are shown.

Table 4: Performance Engineering Activities

Performance Engineering Activities	Phase	Lead Organization	SDLC Artifacts
1 Define Business Need Develop a business case for the system - understand the business problem being addressed by the system, identify and meet with stakeholders, define a high level solution Coordinate with CP steps 1-2 (convert business needs into initial system capacity estimates for costing and capital asset plan) and PM steps 1-2 (convert business needs into performance management needs)	0	Project Office	End-to-End Costing Spreadsheet (E2E) E300 Capital Asset Plan and Business Case Summary Solution Concept
2 Convert Business Needs to Performance Needs/Standards Define high level performance metrics for throughput, response time, processing time, and utilization (CPU, memory, storage, network) Incorporate performance metrics into high level solution Coordinate with CP step 1-2 (convert business needs into initial system capacity estimates for the solution concept)		Engineering	
3 Tailor PE Activities for Project Plan Determine system service type (bronze, silver, gold) via criteria Define specific PE activities for system based on service type	1	Engineering	E300 Capital Asset Plan and Business Case Summary (updated) Acquisition Management Plan
4 Incorporate PE Activities into Project Plan Approve PE activities and incorporate into project plan, acquisition plan, and business case Determine PE activities' schedule, including coordination with other Performance Management activities		Project Office	
5 Decompose Requirements into Detailed Performance Requirements Translate business requirements into performance and capacity requirements, including use cases and assumptions	2	Engineering	Business System Architecture Report (BSAR) Business System Requirements Report (BSRR)

5.   Summary

The Performance Management Service Level and Activities Calculator is intended to be used as a first cut at service level definitions and used during the requirements definition process. The spreadsheet criteria and activities can be customized for each organization's priorities. It can also be used as a first step towards an enterprise-wide standard Performance Management program. Since it is often difficult to make this first step, the Service Level and Activities Calculator can provide a simple tool for developing service levels and defining activities to manage to these service levels.