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Model: 40,000-trial Monte Carlo Simulation

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Monte Carlo Analysis: Proof of Concept BOM Cost Modeling

Executive Summary

This document presents PERT (Program Evaluation and Review Technique) results from a Monte Carlo simulation model for two Proof of Concept (PoC) Bill of Materials configurations, excluding labor costs. The analysis covers a 90-day PoC window with Phase-0 implementation.

Configuration Overview

Beta BOM

Phase-0 minimal configuration comprising:

- Shared VPC infrastructure
- 4 laboratory stacks
- Development sandbox environment
- UI/CLI access path

Final BOM

Beta configuration enhanced with:

- Reconfigurable baseline via IBM Cloud Schematics (no service fee)
- One-time transfer to LRI-owned account
- Cross-account COS copy with 1-month duplicate storage

Cost Model Parameters

Unit Rates (Placeholder Values)

Resource	Rate	Distribution
GPU	$85/hour	Fixed

Resource	Rate	Distribution
Block Storage	$/GB-month	Triangular(0.16, 0.20, 0.24)
Cloud Object Storage (COS)	$/GB-month	Triangular(0.0090, 0.0144, 0.0238)
Egress	$0.09/GB	Fixed

Note: Replace with IBM list pricing as appropriate

Usage Distributions

Per Laboratory (Monthly)

- **GPU Hours:** Triangular(30, 60, 120)
- **Block Storage:** Triangular(200, 512, 1024) GB + 100 GB boot volume
- **COS:** Triangular(200, 500, 1000) GB
- **Egress:** Triangular(5, 20, 50) GB

Development Sandbox (Monthly)

- **GPU Hours:** Triangular(40, 80, 160)
- **Block Storage:** Triangular(100, 256, 512) GB
- **COS:** Triangular(100, 300, 600) GB

Implementation Month

- **GPU:** 2 hours per laboratory
- **Dev Smoke Testing:** Triangular(8, 16, 32) hours

Final BOM Transfer (One-Time)

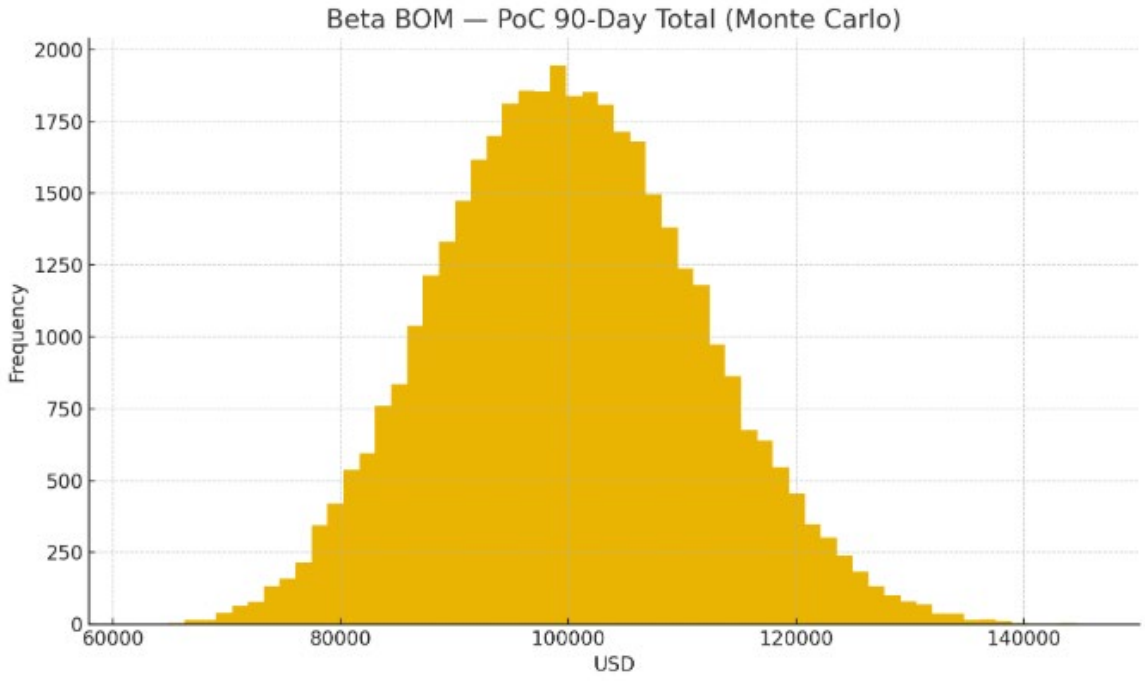
- **Additional Egress:** Triangular(10, 40, 80) GB per laboratory
- **Duplicate COS:** Triangular(100, 300, 600) GB per laboratory for ~1 month

Monte Carlo Results (USD)

Beta BOM - Phase-0 Minimal

Cost Component	P10 (Low)	P50 (Median)	P90 (High)
Implementation Month	$2,305	$2,807	$3,462
Operations (4 Labs/Month)	$20,336	$24,310	$28,599
Dev Full Scope (Monthly)	$5,322	$7,787	$11,039
90-Day PoC Total	**$85,509**	**$99,762**	**$115,022**

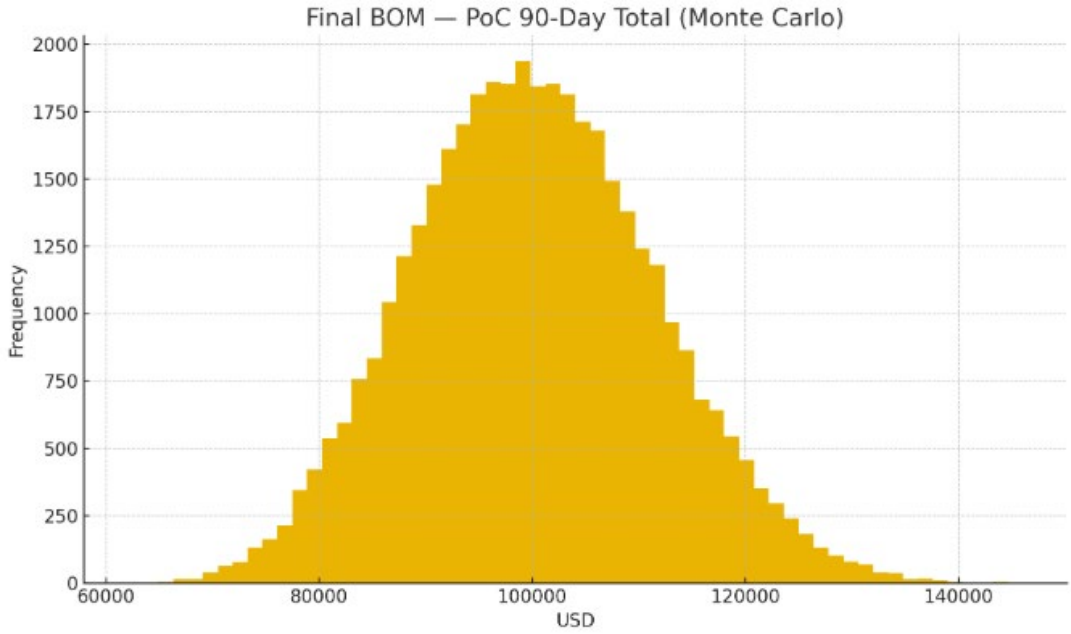
Formula: Implementation (1×) + Operations (3×) + Development (3×)



Final BOM - Enhanced Configuration

Cost Component	P10 (Low)	P50 (Median)	P90 (High)
Implementation Month	$2,305	$2,807	$3,462
Operations (4 Labs/Month)	$20,336	$24,310	$28,599
Dev Full Scope (Monthly)	$5,322	$7,787	$11,039
90-Day PoC Total	**$85,552**	**$99,801**	**$115,057**

Formula: Beta Total + One-Time Transfer Costs



Key Findings

1. **Primary Cost Driver:** GPU runtime represents the dominant variance factor
2. **Secondary Drivers:** Storage and egress costs have minimal impact during Phase-0
3. **Configuration Delta:** Final BOM adds approximately $40 (median) due to one-time transfer costs
4. **IBM Cloud Schematics:** Modeled with $0 service charge for repeatable baseline deployment

Methodology

Simulation Parameters

- **Trials:** 40,000 Monte Carlo simulations
- **Percentiles:** P10/P50/P90 representing low, median, and high estimates
- **Time Horizon:** 90-day PoC window aligned with Phase-0 cadence

Cost Calculation

90-Day Total = Implementation (1×) + Operations (3× monthly) + Development (3× monthly) + Transfer Costs (Final BOM only)

Implementation Notes

- Phase-0 assumes manual "wizard" deployment approach

- Synthetic data utilized for testing scenarios
- 90-day cadence confirmed per project huddle
- Schematics provides infrastructure-as-code capability without additional service charges
- Cross-account transfer in Final BOM includes temporary storage duplication

Distribution Analysis

Monte Carlo distributions for 90-day totals demonstrate normal-like distributions with:

- Beta BOM: Centered around $99,762 median
- Final BOM: Centered around $99,801 median
- Minimal configuration cost differential (~0.04% increase)