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How to Assess Infrastructure Technical Debt to Prioritize Legacy Modernization Investments

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Initiatives: Infrastructure and Operations Leaders

Reducing technical debt is an enabler of digital business, yet it is difficult to assess and communicate which areas need focus. I&O leaders should measure infrastructure technical debt by using business, operational, technical and financial fitness to prioritize legacy modernization investments.

Overview

Key Challenges

- Organizations employ a variety of approaches to estimate technical debt for each type of technology, which makes it difficult for I&O leaders to aggregate an overall view of infrastructure technical debt.

- Typical methods of assessing infrastructure technical debt require more time to perform than I&O leaders can allocate to these efforts, leading to incomplete or stale analysis.

- Charts and reports that I&O leaders use to communicate technical debt concerns are often difficult for nontechnical readers to understand, which limits support for improvement investments.

Recommendations

I&O leaders focused on reducing technical debt must:

- Use a consistent method for structuring infrastructure technical debt analysis into relevant, credible insights by assessing all infrastructure on business, operational, technical and cost factors.

- Create a scalable approach to measuring infrastructure technical debt by using a simple initial assessment to identify which areas need further attention and a slightly more elaborate method to assess high-priority infrastructure elements.

- Make infrastructure technical debt metrics easy to understand by presenting fitness measurements graphically, based on cost versus benefit and technical debt impact.

Strategic Planning Assumption

Through 2023, I&O leaders that actively manage and reduce technical debt will achieve at least 50% faster service delivery times to the business.

Introduction

I&O leaders view legacy modernization as critical to achieving business goals. The top three reasons cited in the 2018 Gartner Legacy Modernization Survey were "increase the level of operational efficiency," "support digital transformation of our company," and "improve service for customers and/or business partners." [1] The 2020 Gartner CIO Survey also found that organizations that are good at removing technical debt are more likely to survive and thrive following a severe disruption. [2]

Unfortunately, I&O leaders struggle to make infrastructure technical debt burdens visible in ways that obtain the investment needed for modernization. In the 2018 Gartner survey on legacy modernization, 17% of respondents cited "calculating a convincing business case" as a top challenge with their organization's approach to core IT system modernization. Thus, I&O leaders must find better ways to make the business case for addressing infrastructure technical debt (see "Shared Incentives for Modernization (Humana)").

To strengthen legacy modernization business cases, I&O leaders must adopt consistent methods for structuring infrastructure technical debt analysis, create a scalable approach to measuring infrastructure technical debt, and make infrastructure technical debt metrics easy to understand (see Figure 1).

Figure 1: How to Effectively Assess Infrastructure Technical Debt

How to Effectively Assess Infrastructure Technical Debt

Source: Gartner (August 2020)

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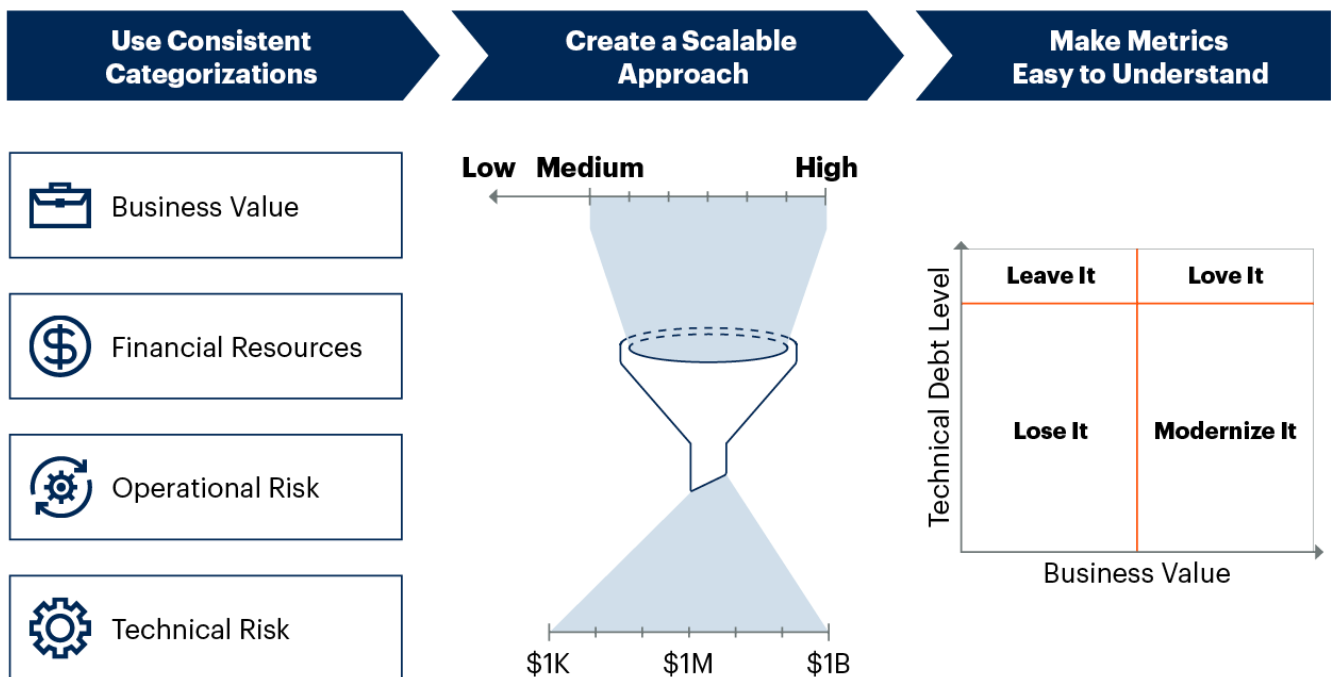
Analysis

Use a Consistent Method for Structuring Infrastructure Technical Debt Analysis

Require that I&O staff use a common approach to assess infrastructure technical debt. When staff use different methods for different technologies, it becomes difficult to aggregate and present analysis in a useful format. Getting to a common basis requires looking beyond the specific characteristics of any specific element of infrastructure and instead focusing on how it impacts business benefits, costs and risks. This also makes it easier to document the approach, train staff on methods and aggregate data across technology types.

Gartner recommends assessing infrastructure technical debt by using four fitness factors: business value, financial resources, operational risk and technical risk. Each of these factors is supported by subfactors to help make these concepts more useful. Table 1 provides an overview of each factor, its focus and commonly used subfactors. [3]

Table 1: The Four Fitness Factors of Infrastructure Technical Debt

Fitness Factor ↓	Focus ↓	Common Subfactors ↓
Business Value	Business benefits enabled by the technology	■ Business application compatibility ■ Data and information quality/timeliness ■ Facility for ease of use and change
Financial Resources	Total cost of ownership (TCO) of the technology	■ Hardware ■ Licensing ■ Maintenance and support ■ Portability

Fitness Factor ↓	Focus ↓	Common Subfactors ↓
Operational Risk	Day-to-day burden imposed by the technology	■ Skills competency (current and future) ■ Compliance (including regulatory) ■ Maintainability ■ Reputational risk ■ Supportability (including vendor viability)
Technical Risk	Adherence of the technology to standards and practices	■ Architectural alignment ■ Continuity and resilience ■ Data protection and privacy ■ Scalability of performance capacity ■ Security

Source: Gartner (August 2020)

I&O leaders can allow flexibility by granting stakeholders the option to add technology-specific subfactors in their assessments, as long as they are included in one of the four fitness factors (see "How to Reduce Technical Debt in Enterprise Networks"). Discourage teams from adding too many subfactors to their analysis, as the additional work and complication will yield little additional value. Keep the purpose of this work clear to reduce the tendency many staff will have to try to perform "complete" analysis that provides no value for decision making. This work will contribute to the broader I&O value narrative, so seize opportunities to bolster overall reporting from this effort (see "Revamp Your Team's Approach to Business Value Metrics").

Create a Scalable Approach to Measuring Infrastructure Technical Debt

As with any assessment of I&O capabilities, the goal of measuring infrastructure technical debt is to focus attention on what most needs improvement, rather than provide a detailed view of everything (see "IT Score for Infrastructure & Operations" and "Use Gartner's I&O ContinuousNext Capability Model to Enable Digital Business Success"). Assign assessment responsibilities to

those best suited to this work and use simple methods to conduct an initial review of all infrastructure. This minimizes the amount of work required by any one person to conduct an initial analysis and keep it up to date.

Begin the assessment by defining the scope of infrastructure to include and assign responsibility for this work in line with broader analysis. Ensure the broader team understands how technical debt is being defined and how the analysis will be used to support improved infrastructure value. Require I&O teams unfamiliar with technical debt assessment to start with a small pilot focused on a few items of greatest concern. As staff become more familiar with the approach, increase adoption in other areas until all infrastructure is being regularly assessed.

Split up responsibility for assessing each factor for a given infrastructure element to increase the credibility of analysis. Consider the following example of how to divide up assignments. Infrastructure architects or other roles familiar with these areas can also do this work as appropriate. While these roles will lead the effort, each element should include appropriate representation from subject matter experts and impacted stakeholders to ensure the analysis is relevant and credible:

- Business value — Application, service or product owner most impacted by the technology element

- Financial resources — IT finance analyst (see "Benchmark Your I&O Value for Core Services")

- Operational risk — IT operations or service desk lead

- Technical risk — Infrastructure element owner

Minimize the effort required to rate each infrastructure element. If analysis is already available for a factor (such as cost information from an ITFM practice), use that information. For everything else, use a simple low/medium/high scale to rate each factor:

- Low — No concerns with the benefits, costs or risks

- Medium — Some concerns regarding benefits, costs or risks, yet not perceived as having significant issues

- High — Significant issues perceived

After this initial pass, subject infrastructure elements with multiple high or medium factors to further analysis for input into legacy modernization business cases. If more detailed analysis is not available, use a consistent scale for categorizing each factor to provide the best balance of insight and required effort. The following scales can be used for each factor:

- Business value — Revenue impact (in intervals of 10: $100/$1K/$10K/$100K/$1M/$10M/$100M) or mission impact (in intervals of 3: 1%/3%/10%/30%/100%)

- Financial resources — Cost impact (in intervals of 10: $100/$1K/$10K/$100K/$1M/$10M/$100M)

- Operational risk — Risk to revenue or mission (in intervals of 10: 0.01%/0.1%/1%/10%/100%)

- Technical risk — Risk to revenue or mission (in intervals of 10: 0.01%/0.1%/1%/10%/100%)

For instance, consider a server that is one of the key supporting pieces of an e-commerce application. The team's analysis of the server's fitness factors yields the following results:

- **Business value**: The e-commerce system supported is expected to provide **$10M** in revenue this year and next.

- **Financial resources**: Due to low downtime and maintenance needs, the cost of support for the server is negligible. Server software licensing has been in the **$100K** range the past couple of years. No changes are expected for the next two years due to the length of the software license agreement.

- **Operational risk**: The most recent business impact analysis (BIA) states that the pool of staff that can operate and support the server has dwindled, which implies a risk of longer downtime or problem duration if issues were to occur. Operational staff estimate that this could potentially reduce uptime to 99.9%, making the potential risk to revenue **0.1%** for this year and next. Other concerns such as compliance are negligible.

- **Technical risk**: The server will be past its end of support life in 12 months and will no longer have patches and fixes available. While there are no current critical or high security vulnerabilities, security analysts expect based on past patterns that new critical vulnerabilities are likely every six months. After discussing these concerns, the team estimates the potential risk at 1% of revenue this year and 10% of revenue next year due to reaching end of life.

Once this is completed, require infrastructure owners to update the analysis on a regular basis. Tailor the frequency of updates to the importance of refreshing the data and how often other processes are performed that use the results. If budget updates are performed on a schedule, update low factors annually and update medium to high factors in sync with the budget update cycle to ensure important changes are not ignored. For infrastructure tied to digital products and services with more dynamic budget cycles, refresh estimates when significant updates or business changes occur.

Table 2 provides a summary of the assessment approach outlined in this section.

Table 2: Infrastructure Technical Debt Assessment Provider and Methods for Each Fitness Factor

Fitness Factor ↓	*Who Should Lead the Analysis* ↓	*Scale for the Initial Analysis* ↓	*Scale for Refining the Analysis* ↓	
Business value	Most relevant application, service or product owner	Low/Medium/High	Revenue impact ($100/$1K/$10K/$100K/$1M/$10M/$100M) or mission impact (1%/3%/10%/30%/100%)	
Financial resources	IT finance analyst	Low/Medium/High	Cost impact ($100/$1K/$10K/$100K/$1M/$10M/$100M)	
Operational risk	IT operations or service desk lead	Low/Medium/High	Risk to revenue or mission (0.01%/0.1%/1%/10%/100%)	
Technical risk	Infrastructure element owner	Low/Medium/High	Risk to revenue or mission (0.01%/0.1%/1%/10%/100%)	

Source: Gartner (August 2020)

While the prospect of assessing technical debt and keeping assessments up-to-date can be daunting, using this incremental, lightweight approach allows for this work to be done quickly, with minimal staff burden.

Make Infrastructure Technical Debt Metrics Easy to Understand

Making infrastructure technical debt metrics easier to understand reduces the barriers to taking action to address them and provides a common terminology that can be shared across technical and business teams. Use a consistent method to display infrastructure technical debt that quickly orients the viewer to the areas most in need of attention, displaying one or both of the following traits:

- The costs imposed by the technology exceed the business benefits it provides.

- Operational and technical fitness gaps pose risks that exceed the organization's risk appetite.

Create a 2x2 matrix to display the infrastructure technical debt findings in a format that meets these requirements. Figure 2 shows a completed example for reference. This format can be used to

display comparisons of individual components or aggregated views by model, asset type, service or other groupings.

Figure 2: A Chart Format for Displaying Infrastructure Technical Debt Analysis Findings

Infrastructure Technical Debt Analysis Findings
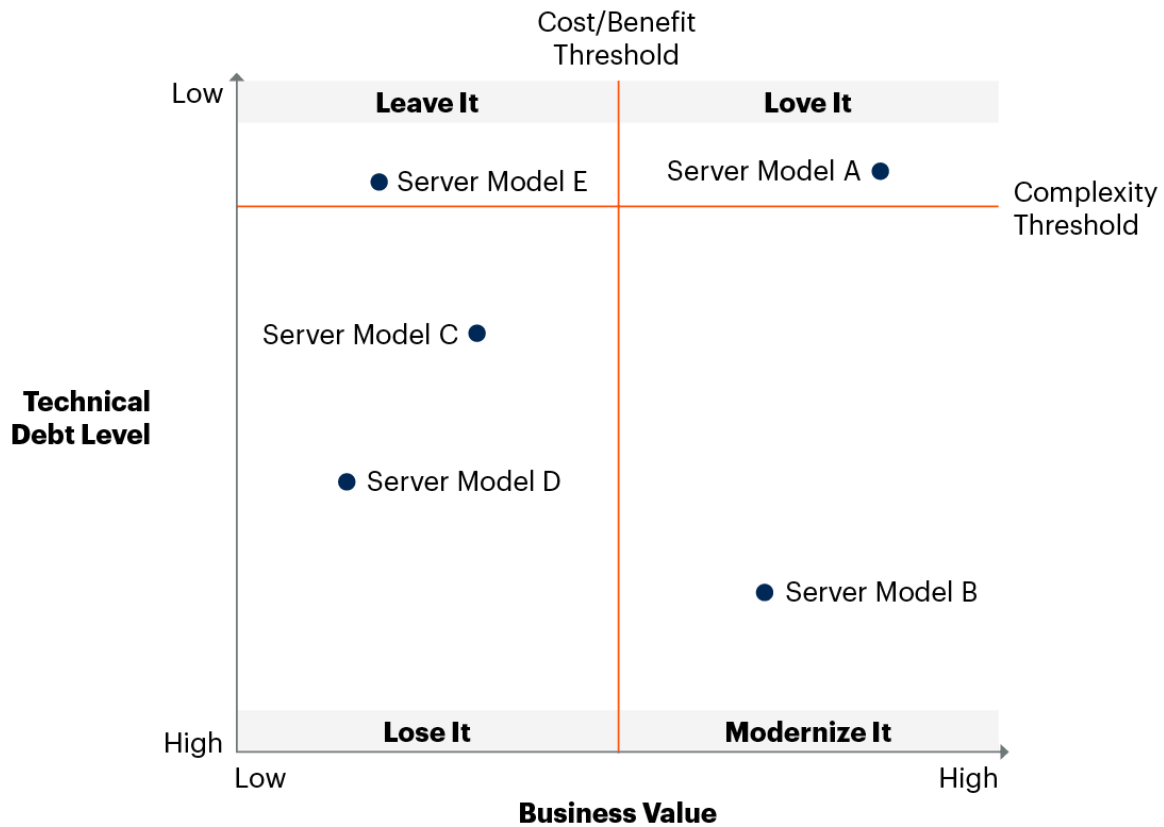
Source: Gartner (August 2020)
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To build the matrix, map the four fitness factors to the matrix using the following formulas for the x and y axes. These formulas can also be used to provide metrics to support the business case for modernization investment (see "Get the Investment I&O Needs and Projects Funded"):

- Revenue-focused organizations:

  - X-axis: Cost-benefit ratio = revenue estimate / cost estimate

  - Y-axis: Technical debt level = (operational risk + technical risk) * revenue estimate

- Mission-focused organizations:

  - X-axis: Cost-benefit ratio = mission impact estimate / (cost estimate / technology budget)

  - Y-axis: Technical debt level = (operational risk + technical risk) * mission impact estimate

The dividing threshold typically will be 1 for the x-axis (benefits equal costs) and a negotiated level of acceptable technical debt per item for the y-axis. This makes it easier for stakeholders to filter out what matters from what does not.

The results can then be used to categorize the results and inform decisions on actions required to reduce unwarranted technical debt (see "Overcome Barriers to Agility by Reducing Technical Debt in I&O"). By tracking these metrics over time, I&O leaders will also be able to evaluate the impact of technical debt investments and build credibility for future investments.

Acronym Key and Glossary Terms

Technical debt	The deviation of a system from any of its nonfunctional requirements.

Evidence

[1] Results presented are based on Gartner's Legacy Modernization survey to understand the stage of legacy modernization, what strategies organizations are pursuing and how legacy modernization will help to drive transformation.

Gartner conducted the primary research online from August 2018 through October 2018 among 659 respondents distributed in the U.S. (n = 224), Canada (n = 56), the U.K. (n = 95), France (n = 56), Germany (n = 58), Australia/New Zealand (n = 40), India (n = 91) and Singapore (n = 39). Respondents were screened for involvement in their organization's core IT systems' modernization activities. Companies were required to have >$250 million in annual revenue and operate in one of the following industries: banking and financial services (n = 111), insurance (n = 101), government (n = 107), manufacturing (n = 110), healthcare providers (n = 88), healthcare payers (n = 32) and higher education (n = 81).

The survey was developed collaboratively by a team of Gartner analysts who focus on digital business, as well as thought leadership on market trends, systems and architecture, and tested and administered by Gartner's Research Data and Analytics team. The results of this study are representative of the respondent base and not necessarily the market as a whole.

[2] 57% of respondents from fit organizations vs. 38% of fragile organizations indicated "our enterprise is good at removing technical debt — it is actively following a robust legacy modernization roadmap." The 2020 Gartner CIO Survey was conducted online from 4 June 2019 through 5 August 2019 among Gartner Executive Programs members and other CIOs. Qualified respondents are each the most senior IT leader (CIO) for their overall organization or for a part of their organization (for example, a business unit or region). The sample includes 1,070 CIO respondents in 64 countries and across major industries (public and private), representing approximately $3.5 trillion in revenue/public-sector budgets and $67.5 billion in IT spending. The survey was developed collaboratively by a team of Gartner analysts, and was reviewed, tested and administered by Gartner's Research Data and Analytics team. To isolate "fit" enterprises, we asked

survey respondents whether their organization faced various kinds of disruption within the last four years and how severe the crises were on a 1-7 scale (7 was most severe). We then asked how well the enterprise performed after the crises on 12 markers of performance — respondents answered on a scale from "far behind" (1) to "far ahead" (5). Enterprises that experienced crises of high severity and came out ahead count as "fit." We call those that came out behind after a severe crisis "fragile."

Results do not represent global findings or the market as a whole, but reflect sentiment of the respondents and companies surveyed. Respondents come from a range of industries: education (20%), government (12%), manufacturing (12%), financial services (11%), professional services (6%), healthcare provider (4%), insurance (4%), retail (4%), utilities (4%), energy (3%), IT (3%), transportation (3%), health payer (2%), life science (2%), telecommunications (2%), media (1%), natural resources (1%), wholesale (1%), other (5%).

[3] Based on input gathered from Gartner inquiries, examination of ISO/IEC 25010, and A. Chanopas, D. Krairit and K. Do Ba. "Managing Information Technology Infrastructure: A New Flexibility Framework." Management Research News. 2006.

Recommended by the Author

Overcome Barriers to Agility by Reducing Technical Debt in I&O

Shared Incentives for Modernization (Humana)

Toolkit: Application Portfolio Business and Technical Fitness Assessment

Optimize Costs by Extending the Life Cycle of Campus and Branch Office Networking Equipment

Reduce Technical Debt for Modernization

How to Reduce Technical Debt in Enterprise Networks

Leadership Vision for 2020: Infrastructure and Operations Leader

Overcoming Resistance to Data Infrastructure Modernization

Recommended For You

Reduce Technical Debt for Modernization

Shared Incentives for Modernization (Humana)

Programmable Infrastructure Is Foundational to Infrastructure-Led Disruption

Technical Debt Reduction Roadmap for Large Enterprises, 2020

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