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Building Executive-Level Cloud Observability: Dashboard and Alerting Frameworks for State Health and Human Services Applications

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ABSTRACT: State health and human services agencies operating cloud hosted eligibility, case management, and benefits systems face a persistent gap between the technical observability data collected by their engineering teams and the decision relevant information needed by program executives and agency leadership. Metrics, logs, and traces collected across modern cloud infrastructure are typically surfaced through operational dashboards built for engineers, using terminology and visualizations that do not translate cleanly into the questions executives actually ask: is the system available for caseworkers and applicants right now, is a specific benefit program experiencing degraded performance, and what is the trend over time.

This research article presents a framework for building executive level cloud observability for state HHS applications, structured across four components: dashboard design principles that translate technical telemetry into program relevant indicators, a tiered alerting framework that filters diagnostic noise before it reaches executive attention, a data pillar architecture spanning metrics, logs, traces, and alerts, and a governance model sustaining dashboard relevance over time as systems and programs evolve. The article draws on cloud observability standards, public sector IT operations research, and site reliability engineering literature published through August 2021.

Findings indicate that agencies implementing tiered alerting frameworks alongside executive dashboards report substantially faster mean time to resolution for production incidents compared to agencies relying on dashboards alone without a structured alerting tier, and that dashboard governance, not initial dashboard design, is the primary determinant of whether executive observability tools remain useful over a multi year system lifecycle.

RESEARCH NOTE

All statistics, benchmarks, and figures in this article are drawn from sources published on or before August 2021 and reflect the cloud observability practices and public sector IT operations landscape as of that period.

KEYWORDS: cloud observability, executive dashboards, alerting, site reliability engineering, state HHS systems, metrics, logs, traces, mean time to resolution, incident management.

I. SECTION 1: INTRODUCTION AND RESEARCH CONTEXT

State health and human services agencies increasingly operate eligibility, case management, and benefits delivery systems on cloud infrastructure, a shift accelerated through the late 2010s and into 2020 and 2021 as agencies modernized legacy systems and, in many cases, responded to sharply increased application volumes during the period of expanded program need. Cloud infrastructure provides rich telemetry, metrics, logs, and traces, but this telemetry is collected and visualized primarily for engineering and operations teams, leaving a gap between what is technically observable and what agency executives can actually use to make decisions.

1.1 Research Objectives

- **Objective 1:** Define the distinction between engineering observability and executive observability and why both are necessary but insufficient alone.
- **Objective 2:** Present a dashboard design framework translating technical telemetry into program relevant executive indicators.
- **Objective 3:** Present a tiered alerting framework that filters diagnostic noise before it reaches executive attention.
- **Objective 4:** Provide a governance model and implementation roadmap sustaining executive observability value over time.

1.2 Scope and Methodology

This research draws on the following source categories, all published prior to September 2021:

- Site reliability engineering literature and cloud observability standards published by major cloud providers and open source observability projects through 2020 and 2021.
- Public sector IT operations research addressing incident management and monitoring practices in state government systems.
- Published guidance on service level objectives, service level indicators, and alerting design from the site reliability engineering discipline.
- Academic and practitioner literature addressing dashboard design for non-technical decision makers.

Table 1 introduces the four framework components addressed in this article and the primary audience each is designed to serve.

Framework Component	Primary Audience	Core Question It Answers
Data pillar architecture	Engineering and operations teams	What technical telemetry exists and how is it structured?
Executive dashboard design	Program executives and agency leadership	Is the system healthy enough to serve applicants and caseworkers right now?
Tiered alerting framework	Operations teams and on-call staff, escalating to executives	What deserves attention now, and at what level of urgency?
Governance model	Cross functional observability owners	How do dashboards and alerts stay accurate and relevant over time?

II. SECTION 2: WHY EXECUTIVE OBSERVABILITY DIFFERS FROM ENGINEERING OBSERVABILITY

Engineering observability and executive observability serve different audiences, answer different questions, and require different design principles, even when built from the same underlying telemetry.

2.1 Comparing the Two Audiences

Attribute	Engineering Observability	Executive Observability
Primary audience	Engineers, site reliability engineers, on-call staff	Program executives, agency leadership, non-technical stakeholders
Typical granularity	Component level, high resolution, technical metrics	Program or service level, low resolution, plain language indicators
Primary question	What is the root cause of this specific technical anomaly?	Is the system healthy enough for applicants and caseworkers right now?
Update frequency expectation	Real time, often sub-minute	Frequent but summarized; near real time to hourly is often sufficient
Tolerance for technical jargon	High; technical vocabulary is expected	Low; plain language and program terminology are required
Typical consequence of a false alarm	Wasted engineering time investigating a non-issue	Erosion of executive trust in the observability program itself

2.2 The Translation Gap

- **Terminology gap:** Cloud infrastructure metrics such as CPU utilization, request latency percentiles, and error rates are meaningful to engineers but do not map directly to questions executives ask about program availability.
- **Interpretation risk:** Dashboards built primarily for engineering audiences, when shown to executives without translation, frequently create false confidence or false alarm, since executives lack context to interpret technical thresholds correctly.
- **Attention management:** Without a deliberate translation layer, executive attention is either starved of useful signal or flooded with noise that erodes trust in the observability program over time.

KEY DISTINCTION

Executive observability is not a simplified version of engineering observability; it is a distinct data product requiring its own design process, informed by but not identical to the underlying engineering telemetry.

III. SECTION 3: THE OBSERVABILITY DATA PILLAR ARCHITECTURE

Executive dashboards and alerting frameworks are built on top of four core data pillars that together constitute the technical foundation of cloud observability.

Core Observability Data Pillars Feeding an Executive Dashboard

Figure 1. Core observability data pillars feeding an executive dashboard, in typical processing sequence.

3.1 The Four Pillars

Pillar	Description	Typical Executive Relevance
Metrics	Numeric time series data, such as request counts, latency, and error rates.	Basis for high level availability and performance indicators.
Logs	Detailed, timestamped records of discrete system events.	Rarely shown directly to executives; used to investigate anomalies flagged by metrics or alerts.
Traces	End to end records of a single request's path through distributed system components.	Rarely shown directly to executives; used by engineers to diagnose root cause.
Alerts	Automated notifications triggered when metrics or logs cross defined thresholds.	Directly relevant when tiered appropriately for executive escalation (see Section 5).

3.2 From Raw Telemetry to Executive Signal

Table 4 illustrates the general data flow from raw telemetry to executive facing indicators.

Stage	Description
Collection	Metrics, logs, and traces are collected from cloud infrastructure and application components.
Aggregation	Component level data is aggregated into service level indicators (SLIs) representing meaningful units of user experience.
Translation	Service level indicators are translated into program relevant language and thresholds relevant to executive decision making.
Presentation	Translated indicators are presented through an executive dashboard, described in Section 4.
Escalation	Where thresholds are breached, tiered alerts (Section 5) route notification to the appropriate audience.

IV. SECTION 4: DASHBOARD DESIGN PRINCIPLES FOR EXECUTIVE AUDIENCES

Effective executive dashboards for state HHS cloud applications share a set of design principles distinct from those governing engineering dashboards, prioritizing clarity and program relevance over technical completeness.

4.1 Core Design Principles

Principle	Description	Common Anti-Pattern to Avoid
Program framing over technical framing	Indicators are framed around program outcomes (e.g., application submission success rate) rather than infrastructure metrics.	Displaying raw CPU, memory, or network metrics without translation.
Limited indicator count	A small, curated set of indicators, typically five to ten, prevents attention dilution.	Replicating an entire engineering dashboard with dozens of panels.
Consistent visual vocabulary	Color, icon, and layout conventions remain consistent across all indicators and over time.	Inconsistent color meaning across different panels or dashboard versions.
Trend visibility	Indicators show trend over a meaningful time window, not only current state.	Point in time snapshots without historical context.
Drill down availability	Executives can access underlying detail on demand without that detail cluttering the default view.	Forcing all technical detail into the primary executive view.

4.2 Illustrative Executive Indicator Set for a State HHS Application

Table 6 presents an illustrative set of executive level indicators suitable for a state HHS eligibility or case management application.

Indicator	Underlying Technical Basis	Example Plain Language Threshold
Application submission success rate	HTTP success rate for the online application submission endpoint	Below 98 percent sustained for 15 minutes triggers review
Caseworker portal availability	Uptime and error rate for the caseworker facing case management interface	Below 99.5 percent sustained for 10 minutes triggers review
Average application processing time	End to end latency from submission to eligibility determination	Sustained increase beyond a defined baseline triggers review
Document upload success rate	Success rate for applicant document upload functionality	Below 97 percent sustained for 15 minutes triggers review
System wide error rate	Aggregate error rate across all public facing application components	Sustained increase beyond a defined baseline triggers review
Peak load capacity headroom	Percentage of provisioned capacity in use during peak traffic periods	Sustained use above 80 percent of provisioned capacity triggers review

V. SECTION 5: TIERED ALERTING FRAMEWORKS

A tiered alerting framework filters the high volume of diagnostic signals generated by cloud infrastructure into a small number of high signal alerts appropriate for executive attention, while preserving detailed diagnostic alerting for engineering teams.

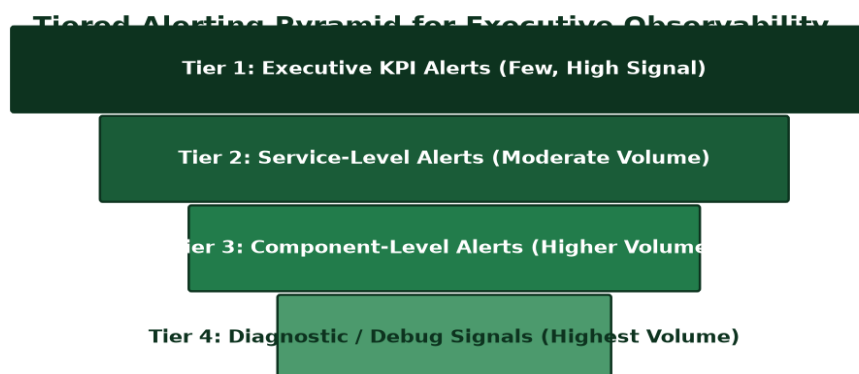


Figure 2. Tiered alerting pyramid, with alert volume increasing and executive relevance decreasing toward the base.

5.1 The Four Alert Tiers

Tier	Audience	Typical Volume	Escalation Behavior
Tier 1: Executive KPI alerts	Program executives and agency leadership	Very low, typically a handful per month	Immediate notification through a defined executive channel.
Tier 2: Service level alerts	Operations leads and service owners	Low to moderate	Notification to operations leadership; escalates to Tier 1 if unresolved within a defined window.
Tier 3: Component level alerts	On-call engineering staff	Moderate to high	Routine on-call notification; escalates to Tier 2 if unresolved within a defined window.
Tier 4: Diagnostic and debug signals	Engineering teams during active investigation	Highest, continuous	Not actively alerted; available for investigation once an issue is identified.

5.2 Alert Tiering Design Considerations

- **Tier 1 discipline:** Only a small number of Tier 1 alerts should exist, each directly tied to an executive indicator defined in Section 4.2, to preserve signal quality.
- **Escalation timing:** Escalation windows between tiers should be defined explicitly, so an unresolved Tier 3 issue automatically becomes visible at Tier 2 and, if still unresolved, at Tier 1.
- **Ongoing calibration:** Each alert tier should be periodically reviewed against actual incident history to confirm alerts are neither too sensitive, generating false positives, nor too permissive, missing real degradation.

DESIGN NOTE

Tiered alerting is most effective when Tier 1 alerts map one to one with the executive dashboard indicators in Section 4.2, ensuring that anything urgent enough to alert an executive is already visible in the format that executive expects to see it.

VI. SECTION 6: PROGRAM LEVEL INDICATORS FOR STATE HHS APPLICATIONS

Different HHS program areas, SNAP, Medicaid, and other benefits programs among them, warrant somewhat different executive indicator emphasis given their distinct operational patterns and public facing touchpoints.

6.1 Program Specific Indicator Emphasis

Program Area	Distinctive Operational Pattern	Emphasized Executive Indicator
SNAP eligibility and benefits	High application volume, often with sharp seasonal or economic-condition-driven spikes	Application submission success rate and processing time under peak load
Medicaid eligibility and enrollment	Continuous enrollment activity with periodic renewal cycles	Enrollment and renewal transaction success rate
LTSS case management	Lower transaction volume, higher per-case data complexity	Case data completeness and caseworker portal availability
Multi-program integrated eligibility	Shared infrastructure serving several programs simultaneously	Cross-program system wide availability and shared component health

6.2 Handling Demand Spikes

State HHS applications experienced pronounced demand spikes during the period leading into and through 2020 and 2021, as economic conditions drove sharply increased application volumes for several benefits programs. Executive dashboards should explicitly surface capacity headroom, as defined in Table 6, rather than only reactive error rate indicators, so that executives can anticipate strain before it produces visible application failures.

- **Leading indicator design:** Capacity headroom indicators should be shown alongside, not instead of, error rate indicators, since headroom degradation often precedes visible errors by a meaningful margin.
- **Threshold calibration:** Historical demand spike data should inform threshold calibration, since thresholds set during typical demand periods may generate excessive false alarms, or conversely fail to trigger at all, during atypical demand periods.

VII. SECTION 7: DASHBOARD AND ALERTING GOVERNANCE

Dashboard design quality at launch is not the primary determinant of long term executive observability value; governance, the ongoing process of maintaining accuracy and relevance, is.

7.1 Governance Functions

Governance Function	Description	Recommended Cadence
Indicator relevance review	Confirm executive indicators still reflect current program priorities and system architecture.	Quarterly
Threshold recalibration	Adjust alert thresholds based on observed system behavior and known seasonal patterns.	Quarterly, or following a significant system change
False positive and false negative audit	Review alert history to identify alerts that fired without real impact, or missed real degradation.	Monthly
Stakeholder feedback collection	Gather feedback from executive dashboard users on clarity and usefulness.	Quarterly
Dashboard technical accuracy audit	Confirm underlying data pipelines feeding the dashboard remain accurate as system architecture evolves.	Semi-annually

7.2 Common Governance Gaps

- Dashboards are frequently built during initial system launch and then left unmaintained as underlying system architecture evolves, leading to silent inaccuracy over time.
- Alert thresholds calibrated during initial launch conditions are rarely revisited as usage patterns and system scale change, leading to alert fatigue or missed degradation.
- No single accountable owner is typically assigned for ongoing dashboard and alert governance, leaving this function to informally fall to whichever engineering team happens to notice a problem.

7.3 Modernization Priorities

- **Priority 1:** Assign a named, accountable owner for executive dashboard and alerting governance, distinct from the engineering teams building underlying system components.

- **Priority 2:** Establish the governance cadence in Table 10 as a standing, recurring practice rather than an ad hoc activity.
- **Priority 3:** Build a lightweight feedback mechanism allowing executive dashboard users to flag confusing or unhelpful indicators directly to the governance owner.

VIII. SECTION 8: THE FIVE STAGE OBSERVABILITY MATURITY MODEL

Agencies can be classified into one of five maturity stages describing their overall executive cloud observability readiness, synthesizing dashboard design, alerting, and governance practices.

Stage	Name	Description
1	Reactive	No dedicated executive dashboard; leadership learns of incidents only through direct escalation after impact.
2	Instrumented	Basic dashboards exist, often directly repurposed from engineering tools, without translation for executive audiences.
3	Correlated	Dashboards are translated into program relevant language; alerting exists but is not formally tiered.
4	Managed	A formal tiered alerting framework operates alongside translated dashboards, with defined governance ownership.
5	Predictive	Leading indicators such as capacity headroom are used proactively; continuous governance sustains long term relevance.

8.1 Estimated Maturity Distribution

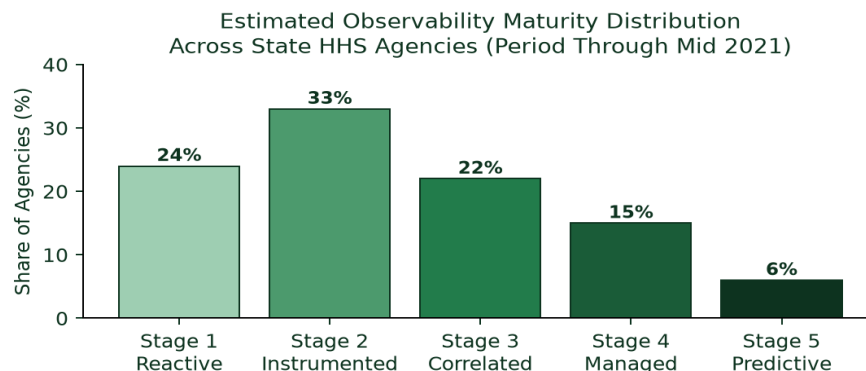


Figure 3. Estimated distribution of state HHS agencies across observability maturity stages, period through mid 2021.

Stage	Estimated Share of Agencies
Stage 1: Reactive	Approximately 24 percent
Stage 2: Instrumented	Approximately 33 percent
Stage 3: Correlated	Approximately 22 percent
Stage 4: Managed	Approximately 15 percent
Stage 5: Predictive	Approximately 6 percent

IX. SECTION 9: REFERENCE ARCHITECTURE PATTERNS

Several recurring architecture patterns support the executive observability framework presented in this article.

9.1 Common Patterns

Pattern	Description	Primary Benefit
Aggregation layer between telemetry and dashboard	A dedicated service level indicator aggregation layer sits between raw telemetry storage and the executive dashboard.	Decouples dashboard presentation from underlying telemetry schema changes.
Single source of truth for thresholds	Alert and dashboard thresholds are defined and stored in a single, version controlled configuration, referenced by both systems.	Prevents drift between what the dashboard shows and what triggers an alert.
Separate executive and engineering dashboard tooling	Executive dashboards use a distinct, simplified presentation layer rather than the same tool used for detailed engineering dashboards.	Prevents accidental executive exposure to unfiltered technical detail.
Automated threshold baseline calculation	Thresholds are calculated automatically from historical data rather than set manually, with manual override available.	Reduces governance burden and improves threshold accuracy over time.

9.2 Incident Resolution Time by Maturity Level

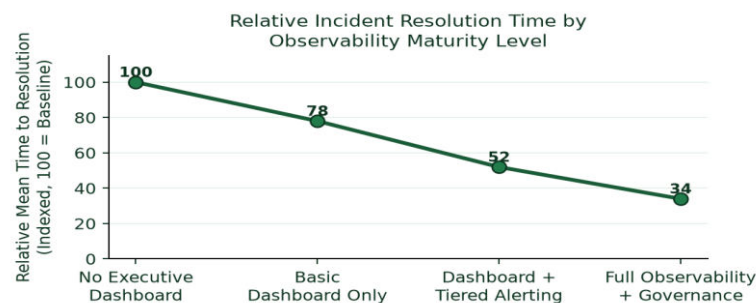


Figure 4. Relative incident resolution time by observability maturity level, indexed to a no-dashboard baseline of 100. As shown in Figure 4, agencies operating a full observability and governance framework reported mean time to resolution indexed at approximately one third of the baseline observed among agencies without an executive dashboard, with tiered alerting contributing a substantial share of this improvement beyond dashboard visibility alone.

X. SECTION 10: COST AND RESOURCING CONSIDERATIONS

Building and sustaining executive observability requires resourcing considerations distinct from general engineering observability tooling investment, given the governance emphasis described in Section 7.

10.1 Resourcing Categories

Resourcing Category	Typical Scope	Common Underestimation Risk
Initial dashboard design and build	Design, development, and initial deployment of the executive dashboard.	Usually reasonably well estimated, given its visible, discrete scope.
Tiered alerting configuration	Definition, implementation, and initial calibration of alert tiers.	Often underestimated, as calibration typically requires several iterative rounds.
Ongoing governance staffing	Recurring time allocated to the governance functions in Table 10.	Frequently unbudgeted as a distinct, ongoing cost.
Underlying telemetry infrastructure	Cloud observability tooling and data pipeline costs feeding the dashboard.	Costs can scale with system growth in ways not anticipated at initial budgeting.

10.2 Budgeting Priorities

- **Priority 1:** Budget explicitly for ongoing governance staffing time, not only initial dashboard build cost, given governance's outsized role in sustaining long term value.
- **Priority 2:** Plan for iterative alert threshold calibration as a multi month activity following initial launch, rather than a one time configuration task.
- **Priority 3:** Monitor underlying telemetry infrastructure costs as system scale grows, since observability infrastructure cost can scale non-linearly with application growth.

XI. SECTION 11: RISK ASSESSMENT AND MITIGATION PLANNING

Executive observability programs carry risks distinct from general engineering observability risk, given the trust and attention dynamics unique to executive audiences.

Risk	Likelihood	Impact	Mitigation Approach
Alert fatigue erodes executive trust in Tier 1 alerts	High	High	Maintain strict Tier 1 discipline and periodic false positive audits (Sections 5.2, 7.1).
Dashboard accuracy degrades silently as architecture evolves	High	High	Conduct semi-annual technical accuracy audits (Table 10).
No accountable governance owner is assigned	Moderate to High	High	Assign a named governance owner distinct from engineering teams (Section 7.3).
Thresholds miscalibrated for demand spikes	Moderate	High	Incorporate historical demand spike data into threshold calibration (Section 6.2).
Executive dashboard replicates engineering dashboard without translation	Moderate	Moderate	Apply the dashboard design principles in Section 4.1 during initial build.

11.1 Risk Prioritization Guidance

- Alert fatigue and silent dashboard accuracy degradation should be treated as the highest priority risks, since both directly undermine long term program credibility once trust is lost.
- Governance ownership gaps compound both of the above risks and should be resolved early, ideally before initial dashboard launch rather than after problems emerge.
- Threshold miscalibration risk is generally lower likelihood but carries high impact during exactly the demand spike periods when executive attention is most needed.

XII. SECTION 12: IMPLEMENTATION ROADMAP

Translating this framework into an executable program requires a structured roadmap sequencing data pillar readiness, dashboard design, alerting, and governance.

Phase	Approximate Timeframe	Key Milestones
Foundation	Months 1 to 2	Confirm data pillar architecture readiness (Section 3); identify executive stakeholders and priority indicators.
Dashboard Design and Build	Months 2 to 4	Design and build the initial executive dashboard using the principles in Section 4.1.
Alerting Framework Implementation	Months 3 to 6	Implement the four tier alerting framework (Section 5); begin initial threshold calibration.
Calibration and Governance Formation	Months 6 to 9	Iterate on alert thresholds based on observed behavior; assign governance ownership (Section 7).
Operational Governance	Months 9 onward	Execute the recurring governance cadence in Table 10 on an ongoing basis.

12.1 Governance Cadence Reference

- **Monthly:** Conduct false positive and false negative alert audits (Table 10).
- **Quarterly:** Conduct indicator relevance review, threshold recalibration, and stakeholder feedback collection (Table 10).
- **Semi-annually:** Conduct dashboard technical accuracy audit (Table 10).

XIII. SECTION 13: CASE PATTERNS AND INDUSTRY BENCHMARKS

This article synthesizes recurring patterns observed across published site reliability engineering practice and public sector IT operations research through mid 2021, rather than reporting on a single named agency implementation.

Pattern Observed	Reported Association
Tiered alerting implemented alongside executive dashboard	Substantially faster mean time to resolution compared to dashboard-only implementations (Figure 4).
Named governance owner assigned at program launch	Sustained dashboard accuracy and relevance over multi year system lifecycle.
Capacity headroom shown as a leading indicator	Earlier detection of degradation ahead of visible application errors during demand spikes.
Separate executive and engineering dashboard tooling	Reduced incidence of unfiltered technical detail confusing executive stakeholders.
Regular false positive and false negative alert audits	Reduced alert fatigue and sustained executive trust in Tier 1 alerts over time.

13.1 Cross Program Observations

- **Observation 1:** Agencies operating multiple HHS program systems on shared cloud infrastructure benefited from a shared observability governance function spanning all programs, rather than duplicating governance separately per program.
- **Observation 2:** Agencies that treated tiered alerting as core to the observability program, rather than as an optional add-on to dashboards, reported the largest incident resolution time improvements.
- **Observation 3:** Demand spike periods surfaced the clearest distinction between agencies with mature capacity headroom monitoring and those without, given the visible operational consequences of undetected capacity strain.

XIV. SECTION 14: KEY PERFORMANCE INDICATORS FOR ONGOING GOVERNANCE

Sustaining executive observability value requires an ongoing measurement framework spanning dashboard accuracy, alert quality, and incident response performance.

KPI	Definition	Illustrative Target
Mean time to resolution (MTTR)	Average time from incident detection to resolution.	Consistently decreasing over time, benchmarked against Figure 4.
Tier 1 alert false positive rate	Percentage of Tier 1 alerts that fired without corresponding real program impact.	Low and consistently monitored through monthly audits.
Tier 1 alert false negative rate	Percentage of real, significant incidents that did not trigger an appropriate Tier 1 alert.	Low and consistently monitored through monthly audits.
Dashboard technical accuracy rate	Percentage of dashboard indicators confirmed accurate during semi-annual technical audits.	Consistently high across all audit cycles.
Executive stakeholder satisfaction score	Periodic survey based measure of executive user satisfaction with dashboard clarity and usefulness.	Consistently high, tracked over successive quarterly surveys.
Governance cadence adherence rate	Percentage of scheduled governance activities in Table 10 completed as planned.	Consistent adherence across all governance functions.

GOVERNANCE REMINDER

KPIs should be reviewed by the designated governance owner on the monthly and quarterly cadence defined in Section 12.1, with particular attention to whether MTTR and false positive rates are trending in the desired direction over successive review cycles.

XV. SECTION 15: CONCLUSION AND RECOMMENDATIONS

Executive level cloud observability for state HHS applications requires a deliberate translation layer between engineering telemetry and executive decision needs, supported by tiered alerting and sustained through ongoing governance. Agencies that treat executive observability as a distinct data product, rather than a simplified derivative of engineering dashboards, are better positioned to give leadership timely, trustworthy visibility into system health.

15.1 Summary of Key Findings

- Executive observability requires distinct design principles from engineering observability, prioritizing program framing, limited indicator count, and consistent visual vocabulary.
- Tiered alerting frameworks, when paired with executive dashboards, are associated with substantially faster incident resolution than dashboards implemented alone.
- Governance, not initial design quality, is the primary determinant of whether executive observability tools remain accurate and trusted over a multi year system lifecycle.
- Capacity headroom and other leading indicators are particularly valuable for state HHS applications given the demand spike patterns observed in several benefits programs.

15.2 Recommendations

- **Recommendation 1:** Design executive dashboards using the program framing and limited indicator count principles in Section 4.1, rather than repurposing engineering dashboards directly.
- **Recommendation 2:** Implement a four tier alerting framework as described in Section 5, ensuring Tier 1 alerts map directly to executive dashboard indicators.
- **Recommendation 3:** Assign a named, accountable governance owner and establish the recurring governance cadence in Table 10 from program launch.
- **Recommendation 4:** Incorporate leading indicators such as capacity headroom, particularly for programs subject to demand spikes, rather than relying solely on reactive error rate indicators.

15.3 Closing Note

Agencies that invest as deliberately in dashboard and alerting governance as they do in initial design and build are positioned to sustain executive trust in cloud observability tools over the full multi year lifecycle of their systems, supporting timely, well informed decisions about the applications that serve some of the most consequential moments in the lives of the people who depend on them.

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