

# Print Management System

College of Computing and Mathematics

## SRS Document

Date: TBA

<b>Project Motivation</b>	<b>2</b>
<b>Project Users</b>	<b>2</b>
Administrator (Admin)	2
Technician	3
Standard User	3
<b>System Overview</b>	<b>4</b>
System Context Diagram	4
Use Case Diagram	5
<b>Use Case Description</b>	<b>6</b>
UC-01: Request Print Job (Submit to Print Queue)	6
UC-02: View Own Printing History Log	7
UC-03: Manage Printing Devices	9
UC-04: Manage Printing Queues	10
UC-05: Modify User Quota	11
UC-06: Manage User Access	12
UC-07: View Logs, Cost Calculations, and Analytics Dashboard	13
UC-08: Receive and View System Error Notification	14
<b>Functional Requirements Specification</b>	<b>15</b>
1. Authentication & Authorization	15
2. Print Job Management (Standard User)	15
3. Print History	15
4. Device & Queue Management (Administrator)	16
5. User & Quota Management (Administrator & Technician)	16
6. User & Quota Management (Administrator & Technician)	16
7. User & Quota Management (Administrator & Technician)	17

# Project Motivation

The primary motivation for this project is to replace the existing PaperCut printing solution used within the College of Computing and Mathematics. Although PaperCut meets basic printing needs, its recurring licensing and usage costs have become a financial burden, and its proprietary nature limits flexibility, transparency, and long-term institutional control.

The proposed Printing Management System aims to provide a cost-effective, internally owned alternative that eliminates recurring fees while giving the college full ownership of system data, features, and future enhancements. A key driver of this project is the need for improved visibility into printing usage and expenses through analytics and cost calculation capabilities, enabling informed decision-making and more effective cost management.

The system will serve all faculty members and undergraduate and graduate students across all departments in the college. It will support multiple user roles, including administrators, technical support staff, and normal users, ensuring secure access, efficient management, and ease of use while reducing costs without compromising printing services.

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# Project Users

## Administrator (Admin)

The Administrator is the highest-privileged user role in the Printing Management System and has full access to all system functionalities. The Admin is responsible for **adding and removing printing devices**, **deleting and configuring print queues**, **modifying user printing quotas**, **managing user access by suspending or restricting users in cases of misuse**, **accessing detailed user and device printing history logs**, **viewing and analyzing printing cost calculations**, and **accessing the analytics dashboard to review usage trends and system statistics**, ensuring effective control, accountability, and informed decision-making.

## Technician

The Technician role has limited administrative access within the Printing Management System and is responsible for supporting day-to-day system operation. Technical Support staff can **manage user printing quotas, manage user access, and receive system notifications related to errors and operational issues**, such as printer faults, low ink or paper conditions, and system failures. This role does not have permission to add or remove printing devices, ensuring separation of responsibilities while enabling timely issue resolution and user support

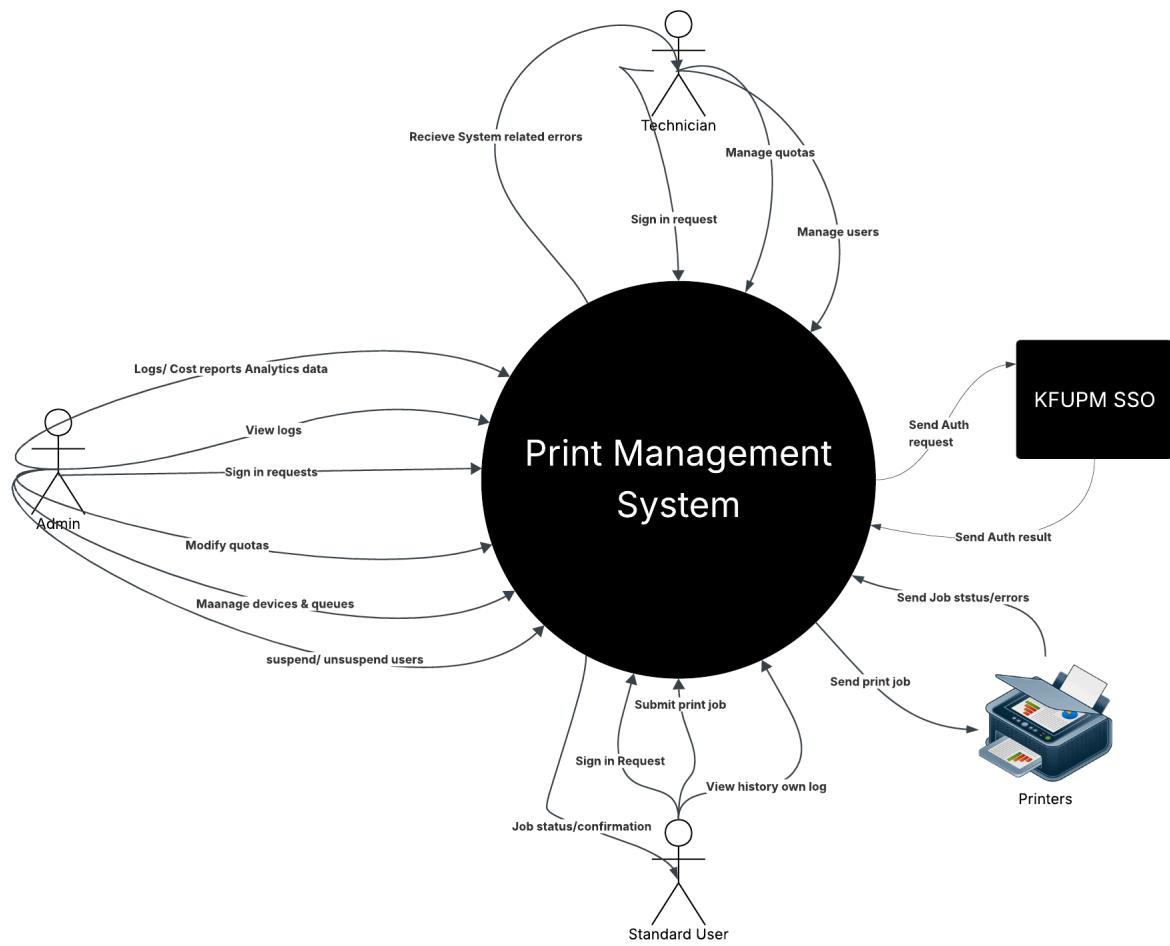
## Standard User

The Standard User represents faculty members and students who use the Printing Management System for regular printing activities. This role allows users to **submit print jobs and view their own printing history logs**, providing visibility into personal printing activity while ensuring that users can only access their own data. Standard Users do not have administrative or system management privileges.

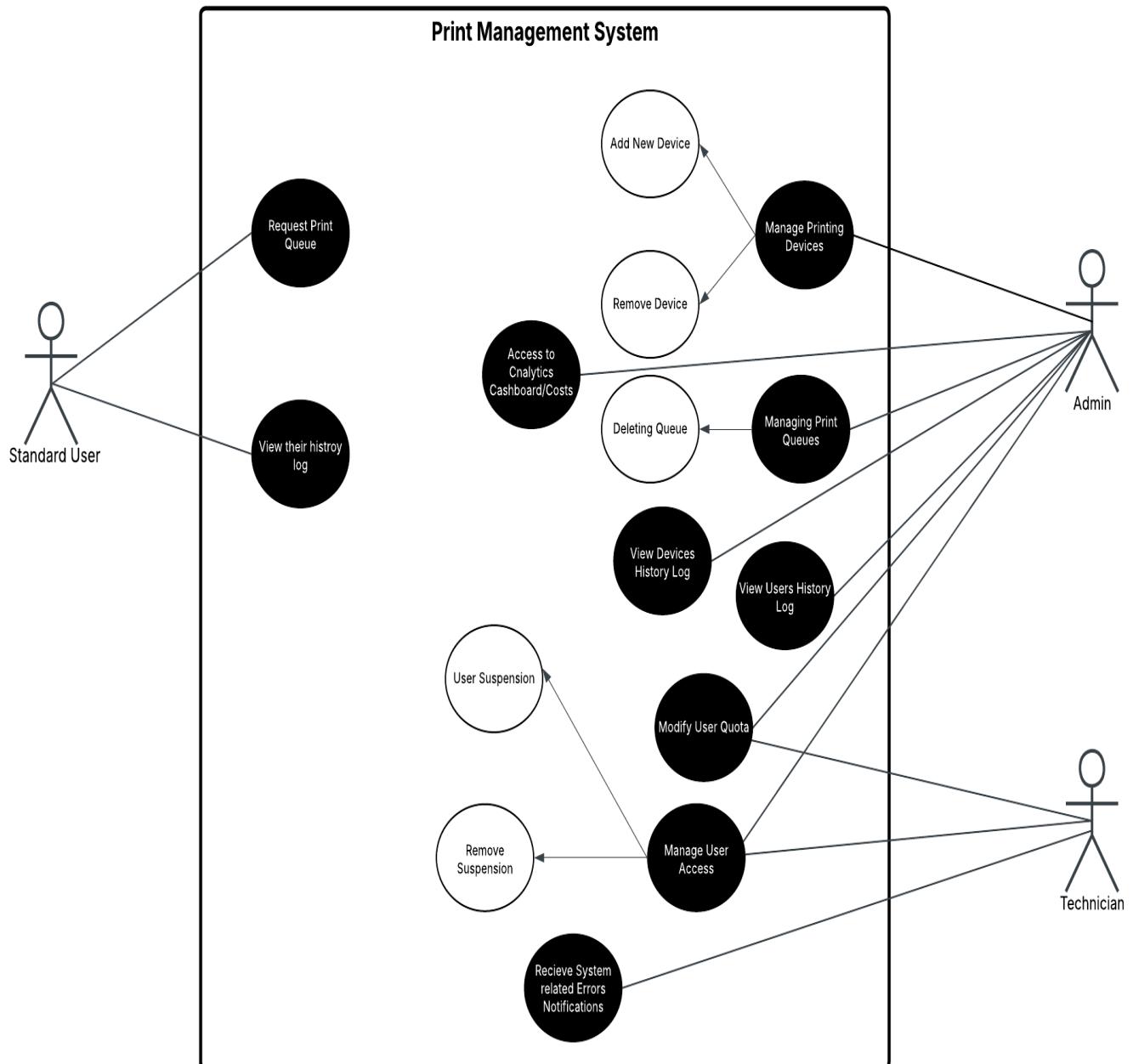
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# System Overview

## System Context Diagram



## Use Case Diagram



# Use Case Description

## UC-01: Request Print Job (Submit to Print Queue)

Id	UC-01
Title	Request Print Job (Submit to Print Queue)
Primary Actor	Standard User
Goal	Submit a document to the printing system and have it accepted for printing.
Preconditions	<ul style="list-style-type: none"> <li>-User is authenticated via University SSO and has an active account.</li> <li>-The user's account is not suspended.</li> <li>-At least one printing device/queue is available.</li> <li>-The User's quota is not exceeded</li> </ul>
Postconditions	<ul style="list-style-type: none"> <li>- A print job record is created in the system</li> <li>- The job is placed in the selected print queue and is either printed or queued for printing</li> <li>- User receives confirmation (or failure) and a job identifier.</li> </ul>
Basic Flow	<ol style="list-style-type: none"> <li>1. User selects a document and chooses "Print" in the client or web interface.</li> <li>2. User selects target printer or queue and print options (copies, color/BW, pages).</li> <li>3. System validates user's printing quota and print options.</li> <li>4. If quota is sufficient, system accepts the job, creates a job record, assigns a job ID, and forwards the job to the selected queue/device.</li> <li>5. The user go to the printer and second verify at the printer using their Id card.</li> <li>6. System returns confirmation to the user including job ID and estimated status.</li> <li>7. The job is printed when the printer is available; job status updates</li> </ol>

	are recorded.
Alternate Flows	<p><b>A1 – Insufficient quota:</b> After step 4, if the user's remaining quota is insufficient, the system rejects the job and informs the user (optionally offer to contact admin or request quota increase).</p> <p><b>A2 – Invalid file / unsupported format:</b> If the document format is unsupported or corrupted, the system rejects the job and provides an error message.</p> <p><b>A3 – Printer fault / unavailable:</b> If the target printer reports an error (paper out, low ink, offline), system notifies the user and suggests alternative queues (if available). The job may be held in a pending state.</p> <p><b>A4 – Authentication failure:</b> If ID authentication fails, the job is not accepted until authentication succeeds.</p> <p><b>A5 – User cancels:</b> User cancels before job submission; no job record is created.</p>
Notes	<p>System shall record timestamp, user ID, job ID, pages, cost estimate, and target device in the job record.</p> <p>System shall provide feedback to the user.</p> <p>Jobs should be traceable for auditing (who submitted, when, and cost).</p>

## UC-02: View Own Printing History Log

Id	UC-02
Title	View Own Printing History Log
Primary Actor	View a personal log of past print jobs (details, status)
Goal	Submit a document to the printing system and have it accepted for printing.
Preconditions	<ul style="list-style-type: none"> <li>- User is authenticated via University SSO.</li> <li>- User's account is not suspended.</li> </ul>
Postconditions	<ul style="list-style-type: none"> <li>- The user is presented with a filtered list of their print jobs and associated</li> </ul>

	<p>details (date/time, pages, title) -No system state is changed (read-only).</p>
Basic Flow	<ol style="list-style-type: none"> <li>1. User selects “Printing History” from the application or web interface.</li> <li>2. System retrieves the user’s print-job records from the database, optionally applying default filters (most recent first, last 30 days).</li> <li>3. System displays the list with key details (job ID, date/time, pages, status) and provides controls for filtering, sorting, and <b>exporting</b>.</li> <li>4. User reviews entries; user may select an entry to view full details (including file name, options, and logs).</li> </ol>
Alternate Flows	<p><b>A1 – No history / empty result:</b> System displays a “no records” message and guidance (e.g., “You have no print jobs in this period”).</p> <p><b>A2 – Authentication failure:</b> If SSO session expired, user is prompted to re-authenticate.</p> <p><b>A3 – Partial data retrieval error:</b> If the system fails to retrieve historical records, an error is shown and the user is advised to retry or contact Tech Support.</p>
Notes	<p>System shall ensure users can only view their own records (data isolation).</p> <p>Entries shall include job metadata required for auditing: job ID, timestamp, device, pages, cost, and final status.</p> <p><b>System may support export to CSV/PDF, include in functional requirements and security checks.</b></p>

## UC-03: Manage Printing Devices

Id	UC-03
Title	Manage Printing Devices
Primary Actor	Admin
Goal	Add, remove, and manage printing devices within the system.
Preconditions	-Admin is authenticated via University SSO.
Postconditions	-Printing device configuration is updated in the system. -Changes are reflected in available print queues and device listings.
Basic Flow	<ol style="list-style-type: none"> <li>1. Admin accesses the device management interface.</li> <li>2. Admin selects to add, remove, or update a printing device.</li> <li>3. <b>If adding a device, the Admin provides required configuration details (e.g., device name, IP address, location).</b></li> <li>4. System validates the information.</li> <li>5. System saves the configuration and updates the device list.</li> <li>6. System confirms successful operation.</li> </ol>
Alternate Flows	<p><b>A1 – Invalid device configuration:</b> System displays validation errors and requests correction.</p> <p><b>A2 – Device currently in use:</b> If attempting to remove a device with pending jobs, the system prevents removal and notifies the Admin.</p>
Notes	All device management actions shall be logged for auditing purposes.

## UC-04: Manage Printing Queues

Id	UC-04
Title	Manage Printing Queues
Primary Actor	Admin
Goal	Create Configure, or delete print queues
Preconditions	<ul style="list-style-type: none"> <li>-Admin is authenticated.</li> <li>-At least one device exists in the system (for queue creation).</li> </ul>
Postconditions	<ul style="list-style-type: none"> <li>- Print queue configuration is updated accordingly.</li> </ul>
Basic Flow	<ol style="list-style-type: none"> <li>1. Admin accesses the queue management section.</li> <li>2. Admin selects to create or delete a queue.</li> <li>3. System validates request.</li> <li>4. System updates queue configuration.</li> <li>5. System confirms completion.</li> </ol>
Alternate Flows	<b>A1 – Invalid queue configuration: System requests corrected input</b>
Notes	

## UC-05: Modify User Quota

Id	UC-05
Title	Modify User Quota
Primary Actor	Admin, Technician
Goal	Update printing quota limits for users.
Preconditions	<ul style="list-style-type: none"> <li>- Admin is authenticated.</li> <li>- Technician is authenticated</li> <li>- Target user account exists.</li> </ul>
Postconditions	- Updated quota is applied immediately to the user account.
Basic Flow	<ol style="list-style-type: none"> <li>1. Admin/Technician selects a user account.</li> <li>2. Admin/Technician modifies printing quota value.</li> <li>3. System validates quota value.</li> <li>4. System updates user record.</li> <li>5. System confirms update.</li> </ol>
Alternate Flows	<p><b>A1 – Invalid quota value:</b> System rejects and requests valid input.</p> <p><b>A2 – User not found:</b> System displays error message..</p>
Notes	

## UC-06: Manage User Access

Id	UC-06
Title	Manage User Access
Primary Actor	Admin, Technician
Goal	Suspend or reactivate user access to the system.
Preconditions	<ul style="list-style-type: none"> <li>- Admin/Technician is authenticated.</li> <li>- Target user account exists.</li> </ul>
Postconditions	<ul style="list-style-type: none"> <li>- User account status is updated (active/suspended).</li> <li>- Suspended users cannot submit print jobs.</li> </ul>
Basic Flow	<ol style="list-style-type: none"> <li>1. Admin/Technician selects a user account.</li> <li>2. Admin/Technician chooses to suspend or reactivate the user.</li> <li>3. System updates user status.</li> <li>4. System confirms action.</li> </ol>
Alternate Flows	<p><b>A1 – Attempt to suspend another Admin: System denies action if restricted by policy.</b></p> <p><b>A2 – User not found: System displays error.</b></p>
Notes	

## UC-07: View Logs, Cost Calculations, and Analytics Dashboard

Id	UC-07
Title	View Logs, Cost Calculations, and Analytics Dashboard
Primary Actor	Admin
Goal	Access system analytics, printing logs, and cost calculation reports.
Preconditions	- Admin is authenticated.
Postconditions	- Admin views up-to-date analytical and reporting data.
Basic Flow	<ol style="list-style-type: none"> <li>1. Admin accesses the analytics/dashboard section.</li> <li>2. System retrieves aggregated printing statistics and cost data.</li> <li>3. System displays usage trends, user activity logs, device logs, and calculated costs.</li> <li>4. Admin may apply filters (by date, department, device, or user).</li> <li>5. System updates dashboard view accordingly.</li> </ol>
Alternate Flows	<p><b>A1 – No data available:</b> System displays appropriate message.</p> <p><b>A2 – Data retrieval error:</b> System displays error and logs issue.</p>
Notes	<p>Dashboard data shall be generated from system records.</p> <p>Cost calculations shall be accurate based on predefined pricing rules.</p>

## UC-08: Receive and View System Error Notification

Id	UC-10
Title	Receive and View System Error Notifications
Primary Actor	Technician
Goal	Receive notifications and review system or printer-related errors to take corrective action.
Preconditions	<ul style="list-style-type: none"> <li>- Technician is authenticated.</li> <li>- System monitoring is active.</li> </ul>
Postconditions	<ul style="list-style-type: none"> <li>-Technician is informed of system issues.</li> <li>-Errors are recorded for tracking and resolution.</li> </ul>
Basic Flow	<ol style="list-style-type: none"> <li>1. System detects an issue (e.g., printer fault, no paper, low ink, system failure).</li> <li>2. System generates an error notification.</li> <li>3. Technician receives notification through the system interface.</li> <li>4. Technician views detailed error information (device, timestamp, error type).</li> <li>5. Technician takes appropriate action outside or within the system.</li> </ol>
Alternate Flows	<p><b>A1 – Notification delivery failure: System logs failure and retries or stores notification for later viewing.</b></p> <p><b>A2 – Duplicate error events: System consolidates repeated errors to avoid redundancy.</b></p>
Notes	<p>Error notifications shall include device identifier, timestamp, and error description.</p> <p>Notifications shall be stored for future reference.</p>

# Functional Requirements Specification

## 1. Authentication & Authorization

- FR-1.1 The system shall authenticate users using the university-provided Single Sign-On (SSO) service from KFUPM.
- FR-1.2 The system shall authorize users based on their assigned role (Administrator, Technical Support, Standard User).
- FR-1.3 The system shall prevent suspended users from accessing printing functionality.
- FR-1.4 The system shall restrict access to system features according to role permissions.

## 2. Print Job Management (Standard User)

- FR-2.1 The system shall allow Standard Users to submit print jobs to an available print queue.
- FR-2.2 The system shall validate user printing quota before accepting a print job.
- FR-2.3 The system shall reject print jobs if the user's quota is insufficient.
- FR-2.4 The system shall generate a unique job identifier for each submitted print job.
- FR-2.5 The system shall forward accepted print jobs to the selected printing device or queue.
- FR-2.6 The system shall provide confirmation or error feedback to the user after job submission.
- FR-2.7 The system shall record job details including user ID, timestamp, pages, device, status, and calculated cost.

## 3. Print History

- FR-3.1 The system shall allow Standard Users to view their own printing history log.
- FR-3.2 The system shall prevent users from accessing other users' printing history.
- FR-3.3 The system shall display job metadata including job ID, date/time, device, number of pages, status.

#### **4. Device & Queue Management (Administrator)**

- FR-4.1 The system shall allow Administrators to add new printing devices.
- FR-4.2 The system shall allow Administrators to remove existing printing devices.
- FR-4.3 The system shall allow Administrators to create and configure print queues.
- FR-4.4 The system shall allow Administrators to add new printing devices.
- FR-4.5 The system shall allow Administrators to delete print queues
- FR-4.6 The system shall prevent deletion of devices or queues that contain active print jobs.

#### **5. User & Quota Management (Administrator & Technician)**

- FR-5.1 The system shall allow Administrators to modify user printing quotas.
- FR-5.2 The system shall allow Technical Support staff to modify user printing quotas.
- FR-5.3 The system shall allow Administrators to suspend or reactivate user accounts.
- FR-5.4 The system shall allow Technical Support staff to suspend or reactivate user accounts.
- FR-5.5 The system shall prevent Technical Support staff from modifying Administrator accounts.
- FR-5.6 The system shall log all quota and access modifications for auditing purposes.

#### **6. User & Quota Management (Administrator & Technician)**

- FR-6.1 The system shall record detailed printing activity logs for users and devices.
- FR-6.2 The system shall allow Administrators to access user and device printing history logs.

- FR-6.3 The system shall detect printer-related errors including low paper, low ink, device faults, and offline status.
- FR-6.4 The system shall generate system error notifications when operational failures occur.
- FR-6.5 The system shall notify Technical Support staff of detected system or printer errors.
- FR-6.6 The system shall store error notifications for future review.

## 7. User & Quota Management (Administrator & Technician)

- FR-7.1 The system shall calculate the cost of each print job based on predefined pricing rules.
- FR-7.2 The system shall allow Administrators to access user and device printing history logs.
- FR-7.3 The system shall detect printer-related errors including low paper, low ink, device faults, and offline status.
- FR-7.4 The system shall generate system error notifications when operational failures occur.