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Metro-area fiber network resiliency analysis

Strengthening network infrastructure for cloud-based services

A metro-area County government's IT Department operates an enterprise data network serving 144 County office locations with approximately 1,800 employees and contractors. As the County prepared to migrate critical business applications—including a planned enterprise resource planning (ERP) application—to cloud-based environments, leadership recognized the need for a comprehensive assessment of their network's ability to reliably support these services.

The challenge

The County faced several pressing concerns about their network infrastructure's resilience and readiness for cloud-based operations. They had experienced multiple service disruptions over the previous 24 months, including power outages at network core sites, fiber damage by wildlife, a car accident impacting utility poles and overhead cables, and unprofessional handling of fiber cables by third parties. These incidents highlighted potential vulnerabilities in both network design and operations standards.

The IT Department sought to answer a critical question: Could the current network reliably support the migration of critical business applications to a cloud-based environment? Beyond immediate reliability concerns, the County also faced uncertainty about the future availability of dark fiber strands leased on short, five-year terms creating obstacles for long-term infrastructure planning.

The County engaged CTC Technology & Energy to assess the reliability and vulnerabilities of the County government's existing data network and operations—and to recommend actions that could improve the network's resilience to potential service-disrupting threats.

CTC's approach

CTC assembled a multidisciplinary team bringing together expertise in fiber and wireless network engineering, outside plant infrastructure, network security, and public sector operations. The engagement followed a structured, four-phase approach:

Phase 1: Discovery and documentation review

CTC facilitated a project kick-off meeting with the County stakeholders to discuss project parameters, identify areas of concern, and establish communication protocols. The team then worked closely with County personnel to collect and organize available information, including network maps and GIS data, equipment inventories and configurations, documented policies and procedures, organizational charts, service contracts, and network support records.

144 County locations supported by a single enterprise network

1.8K employees and contractors rely on this infrastructure daily

Phase 2: Infrastructure matrix development

The CTC team created a comprehensive matrix of infrastructure attributes and inventory documentation to support both maintenance operations and risk analysis. This matrix included detailed characterization of connecting fiber segments, physical path redundancy, fiber termination configurations, network hardware locations and redundancy, backup power capabilities, environmental controls, physical security provisions, and service contract information.

Phase 3: On-site assessment

CTC deployed engineers for targeted on-site inspections and interviews over several days. The field work included randomized outside plant sampling to validate as-built data and identify maintenance issues; surveys of key network hub facilities, the data center, and aggregation nodes to assess resiliency, security, and capacity; network configuration and management system reviews; and structured interviews with County personnel covering operations support topics.

Phase 4: Analysis and recommendations

Drawing on insights from the assessment, CTC prepared a comprehensive gap analysis comparing the current state of the County systems to recommended end-states for network architecture, facilities, and operations support. The analysis identified risks by likelihood and impact, prioritized remediation approaches, and provided cost considerations for implementation.

Key findings

CTC's assessment revealed both significant strengths and critical vulnerabilities across three major infrastructure domains:

Network architecture strengths and gaps

The network backbone demonstrated solid fundamentals—using dedicated dark fiber to provide excellent internal connectivity among large County locations and the data center. However, the network had grown incrementally over time through tactical upgrades rather than strategic modernization, leaving it well-designed for internal connections but less prepared for high-quality external connections to internet and cloud destinations.

CTC identified three key deficiencies in the network edge architecture: Inadequate equipment capacity to support expected traffic volumes; a single point of failure where all external connections converged at one location; and insufficient internet services for supporting critical business applications.

Facility infrastructure concerns

While three locations demonstrated exemplary installations with proper equipment mounting, dual HVAC systems, and dual uninterruptible power supplies, most other facilities showed deficiencies.

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Power resiliency emerged as a critical concern. All network locations relied on distributed, rack-mounted UPS units with limited battery capacity—often providing only 10 minutes of backup runtime. Of the County's five backbone sites, only two were equipped with standby generators. Given that power failures account for many data center outages industry-wide, CTC recommended assigning power resiliency remediation as a high priority.

Installation standards varied widely across locations. Except for the three exemplary sites, network equipment installations generally did not meet industry standards, with poor cable management, lack of proper labeling, inconsistent rack mounting, and missing physical protection from accidental damage.

Operational process gaps

The County's infrastructure monitoring systems did not provide adequate network status awareness, forcing the IT Department to rely on end users and Facilities Management for problem notifications. The team had been using limited open-source monitoring tools but was in the process of transitioning to a more robust platform.

Recommendations and prioritization

CTC organized recommendations into a clear priority framework spanning critical, high, and medium-priority actions:

Critical priority (network functionality)

- Modify backbone connectivity to eliminate single points of failure
- Upgrade perimeter firewalls and border routers to support expected capacity
- Add a second public edge location for physically diverse internet connections
- Replace existing internet service with dedicated internet access from a Tier 1 fiber provider with dual-homed connections

High priority (infrastructure resilience)

- Upgrade to centralized UPS systems in primary backbone locations
- Implement Tier 3-compliant on-site power generation for critical facilities
- Install redundant HVAC systems with proper thermal management
- Adopt and enforce strict installation standards aligned with industry best practices

Medium priority (operations and long-term planning)

- Implement a building management system for environmental monitoring
- Develop a strategy for replacing leased dark fiber
- Expand the department's network monitoring scope and implement trouble ticketing
- Establish formal change control processes

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Strategic infrastructure expansion

For long-term fiber independence, CTC developed a strategic expansion plan that would eliminate dependency on leased dark fiber while extending connectivity to additional County facilities. The recommended fiber ring architecture would leverage existing County and metro-area fiber assets, requiring approximately $1 million in strategic construction to provide route redundancy to all main locations within the County and achieve fiber connectivity for about 90 percent of County employees.

Project outcomes and impact

The CTC assessment provided the County with a comprehensive roadmap for network modernization aligned with cloud service migration requirements. The structured priority framework enables the IT Department to pursue improvements strategically—addressing the most critical vulnerabilities first while planning longer-term infrastructure investments.

The analysis moved beyond identifying problems to providing actionable solutions with clear technical specifications, cost considerations, and implementation sequences. For example, CTC's recommendation to add a second public edge could be deployed quickly and cost-effectively using a dedicated locking cabinet to address interim security concerns. The County now has a clear understanding of which infrastructure improvements will have the greatest impact on network reliability and can make informed decisions about capital investments. It is already acting on several recommendations, including procuring upgraded hardware for the public edge and evaluating dedicated internet access services.

CTC is ready to help you evaluate your IT network resilience

CTC's comprehensive resiliency assessment demonstrated our ability to deliver independent, expert analysis that protects public sector clients' interests. By combining deep technical expertise with practical operational experience—including firsthand knowledge from managing similar networks—CTC provided the County government with insights that go beyond generic consulting recommendations.

The approach showcased CTC's collaboration. We worked closely with County staff throughout the assessment process and benefited from the knowledge and constraints of the client organization. As the County implements these recommendations over the coming years, the IT Department will be well-positioned to support cloud-based services while serving the County's employees and residents.

For public sector entities facing similar challenges with aging infrastructure, cloud migration requirements, or network reliability concerns, CTC has demonstrated capabilities in delivering thorough, practical assessments that lead to measurable improvements in network resilience and operational confidence.

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