BOTTLING LIGHTNING: "IT" HAPPENED IN NEBRASKA

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Project Completed: March 2021

NEBRASKA

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OFFICE OF THE CIO

INTRODUCTION

Thunderous clouds brood lowly over the rolling Nebraska plains. Wind picks up waving the fields of grain in the birthplace of ideas like the only State Unicameral and the invention of the strobe light, and Kool-Aid to go with our famous corn-fed beef Runza sandwiches. Lightning sparks like giant nerve synapses, communicating ethereal ideas across the panorama. *To have accomplished success in an unlikely way -- Nebraskans have bottled so much lightning in this Great American Desert.*

Nebraska's AS/400 hosting service transcends technology. Like bottling lightning, to have accomplished it was unlikely. It was unlikely that a State technology service provider could earn buy-in from hundreds of county stakeholders (and steak lovers) to become a trusted partner. The following chapters describe how they did it, all with a State-architected hosting solution, a solution that improved security, service reliability, and saved taxpayers millions of dollars.

In Q1, 2021, Nebraska migrated the 88th and final county-owned IBM AS/400 server to the State's virtual hosting environment. The total effort involved cooperation from nearly every level of State and County governments. This unique project is being nominated by the State CIO for NASCIO recognition in the category of Cross-Boundary Collaboration & Partnerships.

EXECUTIVE SUMMARY

In the early 1990s, before the existence of Client/Server technology, the State of Nebraska needed to install IBM AS/400 servers in every county across Nebraska. Since then, with high-speed Internet available to many of Nebraska's 93 counties, it was time to round up the servers and bring them back to the corral. Resources from the Office of the CIO (OCIO) were tapped in 2009 to perform an assessment before the next round of "server refresh" (or server replacements). 110 Aging State-owned AS/400s were sprawled across the state to provide services at the county level; the question wasn't whether to replace them, but "how?".

Counties purchased and maintained their own AS/400 servers too. Virtually all 93 Nebraska counties had two machines, each as big as an ox, residing in their courthouses. The servers sat side by side, yet without any redundancies. Since one server was owned by the State and the other owned by the county, they supported different applications to do different jobs. Even though they supported multiple critical tier apps, the servers often went without upgrades. Support was a growing burden each year as the machines outlived their lifetimes, the alternative to replacement. The locations presented persistent security risks. Servers were vulnerable to outages, powered by local electricity, a shared utility among all tenants of the building, and the spaces didn't quite meet cooling standards (let alone industry data center standards).

From their assessment, the OCIO found an unexpected business opportunity. The AS/400s were

being underutilized, by a long shot, particularly in rural counties where population sizes were small. A consolidated environment was feasible and would be more cost efficient for taxpayers. The State Data Centers provided the location with the infrastructure necessary to support a hosting service; they were secure, cooled, and facilitated support efficiencies and scheduled maintenance. If the State's systems could benefit from the security, space, cost, and support of hardware, they figured the county systems could benefit too, but they would first need to earn support and buy-in. Together with their vendors and strategic partners, the OCIO architected a practical environment and proposed a two-phased strategy to implement it:

Phase 1: Secure agency partnership. Consolidate all State-owned AS/400 servers into one pair, migrate installed applications. Replicate the servers across two secure data centers.

Phase 2: Gain county buy-in. Consolidate county owned AS/400 servers in a second pair, migrate all installed applications and replicate the servers across the two secure data centers.

By March 2021 Nebraska successfully eliminated a total of 198 IBM AS/400 servers from 93 county server closets. In the process, the cross-functional team migrated 398 installed applications from 198 servers, to two consolidated server pairs, fully replicated across the State's two geographically diverse data centers.
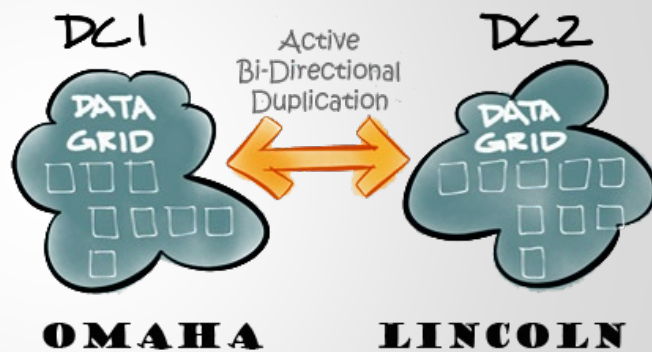
Support from State Partners

When it came to forming partnerships at the State level for an AS/400 Cloud service, the OCIO was well positioned. Some of the State's AS/400s were already prime for a refresh. Those servers supported applications for the Department of Motor Vehicles (DMV) and the Nebraska Supreme Court (NSC), such as Vehicle Title and Registration (VTR) system and the Court's Case Management (JUSTICE) system. Instead of allowing 110 servers to age out and refresh 1:1 over the next decade, the divisions would purchase a pair of servers and the OCIO would replicate them across their two data centers, then they would decommission the remaining servers that were situated in the counties.

The OCIO leveraged cost and a service level agreement with their tenants. The servers would have a logical partition for every county in the state running the JUSTICE and VTR software. The logical partitions could host the needed applications and took the burden of support, backups, and hardware costs from the counties. Tenants would save millions over the life of the servers; cost efficiency was clearly on the side of the Cornhuskers. As a requirement, the OCIO committed to refreshing the hardware keeping up with the latest technology available to ensure reliable service. The OCIO team began installing servers in the State Data Centers and started migrating State applications in 2011.

Earning County Buy-in

In the counties, Phase 1 freed up office space, provided data security, and demonstrated the reliable State-supported system. The DMV and NSC partnership had traction. Counties were aware of the State's Phase 2 plan; a second pair of servers to house the consolidated county systems. Splitting a pair of servers would be cost effective, true. The OCIO's cost recovery model would bill only for the services used and splitting infrastructure costs with the other stakeholders sounded good. Still, county officials hesitated, consolidating county servers on a State system -- it was unheard of. The consultants said it couldn't be done (the order was too tall in the teeth, they said).

The OCIO needed unanimous consensus from each county commission, board, clerk, treasurer, etc. So, they pulled themselves up by their bootstraps and took their lightning bottle idea to "the voice of the counties", the Nebraska Association of County Officials (NACO) in 2015. NACO, a non-profit organization, serves to represent the interests of elected and appointed county officials. The OCIO calculated if their business case could earn NACO support, the counties would buy in.

The Case for Cost Avoidance

To put it mildly (for a Nebraskan's flavor palate), the county owned AS/400 servers were outdated, oversized and amassing expense. Costs to the counties were factored in the following ways:

- Counties individually purchased AS/400 servers; typically, this cost $12,000 – $20,000, plus maintenance for the hardware and software, costs to have it installed and setup, costs for backup tapes, printers, and PC's.

- Lagging system upgrades exposed data to security and technology gaps.

- Utilization was exceptionally low. The infrastructure was not cost-efficient for single county dedicated use.

- Counties were paying expensive maintenance and support, relying on the vendor for such service.

"The transition from physical servers located in courthouses across the state to consolidated virtual servers with DR pairs has increased our overall security position as well as our reliability and uptime for staff and judges while simultaneously bringing down costs. The project has also saved the counties and local court staff from being responsible for bare metal servers kept locally in closets and having to manually back up to tape. The migration was a much-needed upgrade which has been a key component in preserving the long-term viability of our JUSTICE program."

Jennifer Rasmussen - Nebraska Supreme Court

- They were literally at the whim of the windy Great Plains; Servers solely relied on local power with no backup power. Therefore, systems went down when local power went out.

- Servers went down without redundancy or replication, and to increase the risk of productivity loss (and long lines at the DMV or disruption to Supreme Court proceedings) the only data backup was supplied by tapes.

- Calls for maintenance could be especially taxing. Nebraska is 430 miles long, driving east to west; it is ranked the 16th largest area of the 50 United States. Lincoln, the capitol, is in the southeast portion of the State. If systems went down, State support would have required up to 12 hours of IT travel time, mileage, meals and hotel cost.

The NACO Agreement

The voice of the counties was listening. They made two requirements of the hosting providers: 1) reliable system availability and 2) good customer service. The OCIO needed only refer to its Phase 1 migration to show they could satisfy the first requirement. They had security, high availability, and real-time backup with two redundant server pairs.

One of NACO's services to the Nebraska counties is writing custom software, provided from a subsidiary organization, Multi-County Information and Programming Services (MIPS). Counties use MIPS applications to manage Payroll, Accounts Payable, Retirement, Budget, Voter Registration, Personal Property Billing, Real estate, etc. Any work on the systems would need to be done by MIPS. So, in order to meet the second requirement, the OCIO worked out an agreement with MIPS to install all of the county applications on the State AS/400, define the printers to the AS/400, and setup user ID's and passwords. Additionally, MIPS personnel would have full time access to the State's severs for software support and maintenance. For extra assurance, the OCIO opened its 24x7 support desk directly to the counties for AS/400 services.

NEBRASKA BY THE NUMBERS:

- 88 of 93 Counties in Nebraska have applications on the State's consolidated servers.

- 398 Installed applications migrated to one of two completely redundant AS/400 pairs.

- 198 Servers living in the counties were decommissioned and eliminated.

Lifetime (average) Cost of an AS/400:

… $12,000 – $20,000 (Plus maintenance, installation, backup, printers, and PCs)

Annual Cost Savings average for Nebraska Counties:

… $2,850 Per county-owned server

… $1.25 Million cost collectively avoided by 88 counties over five years.

Now having formed a partnership, the State-OCIO and NACO crafted a joint message to the counties; NACO would support the State's AS/400 hosting service. The OCIO followed up, reaching out to counties. They explained the migration process and asked the counties to help plan a timeline — when could they ditch their server closets once and for all? They ensured each county's unique requirements could be met, then involved MIPS and the OCIO's Midrange team to begin the migration process.

The people process took much time. County officials discussed, voted, and sometimes circled back to revise the requirements. Once the hard work was done, the OCIO could begin the technical work; such was the process for six years. The first of the Phase 2 county migrations took place in late 2015; 69 counties had joined by July 2018; and finally, in 2021 the 88th and last apposite county joined the State's consolidated AS/400 hosting solution.

Impact

The primary reason for Nebraska's success was the State's ability to provide a competitive level of service. This can only be replicated where the infrastructure exists to support a hosting service. Success can be observed in the following ways:

1. Compared to what the counties had previously paid for hardware, software and support the State's solution reduced overall cost up to 90% for some counties (average per OCIO cost analysis). Previously, each county budgeted for fully equipped, fully supported AS/400 hardware, software licensing and ongoing support. The State consolidated those AS/400s, partitioned them and split cost 88 ways. The cost recovery model bills each county for the applications and services used. The OCIO concluded collectively the counties gained a minimum Annual Cost Avoidance of $2,850, which in five years (typical lifetime of the server) saves over one million dollars.

2. Going from a single server without any redundancies to the State's dual-located, completely redundant servers in the Lincoln and Omaha data centers far exceeded what availability that the counties were previously afforded. The State consistently achieves availability of 99.95% uptime for the virtual AS/400 environment (see graph below).

Service Availability
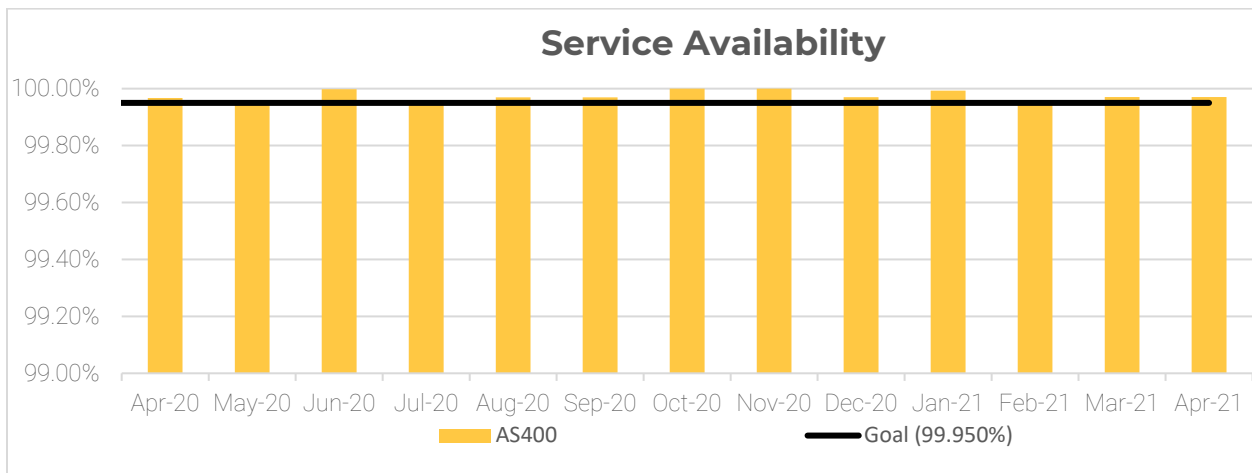
3. The OCIO refreshes data center hardware to keep the technology current, which provides faster and more reliable service. The service provider, not the county, maintains the latest software patches and updates. The OCIO staff works with MIPS to send out any application updates to the counties. Counties don't have to do anything on these tasks, and the State notifies them in advance of any planned outage.

4. After consolidation counties were able to upload Personal Identifiable Information (PII) in an approved and secured manner.

5. NACO support did two things for the State: a) established a working relationship with county partners, especially once the State showed they were able to meet the requirements; b) allowed the OCIO to prequalify as reliable, worthy partner for local municipalities with a dependable solution at a more reasonable cost.

6. All NACO and MIPS conditions were exceeded. The State continually optimizes its two fully redundant data centers. The collocated institutions each have dedicated power supply with backup generator. State and County AS/400s benefit from the redundancies between hardware, data replication and power as this has been tested in recent years.

7. Software maintenance and hardware issues are all done by the OCIO at no additional cost to the counties. The counties are no longer responsible to troubleshoot cooling, security, tapes, electric wiring, etc. The OCIO does routine maintenance, installing program temporary fixes to the operating system. These often contain security enhancements.

8. The entire process of supporting AS/400 servers became more efficient. The OCIO opened its 24x7 support desk to the counties. However, the impact to the service desk was minimal due to the efficiency and redundancy of the new environment.

9. The OCIO's cost recovery model for the project was replicated in the State Agency infrastructure consolidation (completed in 2018).

10. This project is also realizing the benefits of the infrastructure consolidation of 2018 with Statewide Site Support supporting the counties.

In conclusion, Nebraska's cross-boundary collaboration and partnership showcases that collaboration between State and local governments can improve services for taxpayers. By becoming a hosting service provider, the State of Nebraska demonstrated its leadership and commitment to their customers across the state. As the State expected it to be, this project is worthy of the investment because of the gained service reliability and cost savings. Ongoing investments will be focused on maintaining high availability, efficiencies, and improving customer service -- any of which will benefit the citizens.

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