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Google Apps for Education: Valparaiso University's Migration Experience:

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ABSTRACT

Many campuses are investigating cloud-based or hosted email solutions. This paper will cover Valparaiso University's decision to move to the Google Apps for Education platform and our campus migration strategy. Google Apps offers significant savings in both cost of service and cost of support / maintenance while simultaneously offering functionality improvements to the campus experience over our previous system. Valparaiso University was using the GroupWise email and calendaring system and began the process of migrating all of campus to the Google Apps for Education platform in early 2011. Our process began with a student led evaluation team to select the new platform and started rolling out to new students beginning summer of 2011 with migration of existing students conducted from July 2011 through October 2011. Faculty / Staff migration began in December 2011 and were rolled out on a department by department basis throughout the spring 2012 Semester. Heavy promotion and utilization of multiple "Meet Google Apps" presentations greatly enhanced communication about the process and reduced migration anxiety. Apps were limited during migration process to those that reproduced existing system functionality to avoid over-taxing IT support resources. Valparaiso University's migration process has been refined several times and overall feedback from students, faculty, and staff has been very positive throughout the process.

Categories and Subject Descriptors

H.4.0 [Information Systems Applications]: General

General Terms

Documentation, Human Factors, Management.

Keywords

Electronic Mail, Google Apps, Migration.

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1. INTRODUCTION

1.1 Valparaiso Overview

Valparaiso University is an independent Lutheran institution located in Valparaiso, Indiana, a city of 31,000 people, in Northwest Indiana just an hour east of Chicago. Valpo hosts more than 4,000 students from most states and 50 countries enrolled in more than 70 programs in five colleges: Arts and Sciences, Business Administration, Engineering, Nursing, and Christ College (the honors college). Valpo employs around 1,400 faculty and support staff.

1.2 Why We Needed to Leave Novell

GroupWise®

Balancing the delivery of services against escalating costs (capital, maintenance, and support) in a budget constricting economy is an ongoing challenge for all IT departments. Novell GroupWise® was a cost-effective decision when packaged alongside other Novell products but with our intention to transition the university onto an Active Directory infrastructure, it made sense to find an alternative to GroupWise for the university's email and calendaring needs.

The student population is increasingly tech savvy and adept at mastering web-based applications. The increased demand for mobile device support with email and calendaring is also a strong motivating factor for looking at web-based applications.

In addition to reduced maintenance costs, we estimate that we are going to save 10-20 hours a week of System Administrator time that was necessary to support our older and limited GroupWise installation.

1.3 Choosing Google Apps

A student focus group was allowed to make the decision between Google Apps for Education and Microsoft Live@Edu. During the 2011 spring semester, the student focus group used each platform as their primary email system for a period of 4 weeks. An anonymous survey was used to collect feedback and the results showed an overwhelming majority preference for Google Apps; only one student selected the Microsoft option.

2. MIGRATION CONSIDERATIONS

2.1 In-House vs. Cloud-Based

Student use of GroupWise was limited to the web access client and virtually no students used the calendar functionality. Faculty and Staff, however, had different needs and demands than the student population. This led to an internal discussion on whether

we should run our own Microsoft Exchange servers for faculty / staff while the students used Google Apps. There was a perception of greater control and trust in maintaining our own internal system. The arguments against running two separate systems were: reduced savings on server maintenance contracts, limiting the savings to system administrator time, continuing the need to maintain use of our Sophos PureMessage spam and virus filtering systems, and complications in managing dual email services, especially for those individuals who have employee and student status.

2.2 Technical Considerations

Any service that we chose needed to have a robust API to allow for integration with our current processes for the automatic creation of accounts. We also needed our next platform to integrate with our current authentication systems so users would continue to have one password for everything. Google's provisioning web service fit the bill perfectly and handled all of our needs with regards to these issues.

2.3 Mobile Support

Moving to Google Apps allowed for better support of mobile devices and integration into with a variety of other outside services. Because of the more standards compliant nature of Google (especially compared to Novell) and Google's constant development of the product, any future tech trends will be easier to address by our internal developers or may not need to be addressed at all.

3. STUDENT MIGRATION PROCESS

3.1 Online Presence

One very useful tool we used in communicating with campus was the IT department's website. We created a whole section of the website with FAQ's, tip sheets, schedules, statistics, training information, and much more. We also created an easy URL (valpo.edu/googleapps) for the website so that we could easily direct users to the site. This was in place for the student migration and grew throughout the process as additional information and documentation was available. Google's help pages covered the majority of the information we needed to disseminate so the focus of our website was facilitation and redirecting people to the appropriate help pages. We also posted a live migration stats page on the website that allowed campus to see exactly how many had gone through the migration process already.

3.2 Freshmen Bypass

Valpo sees the majority of incoming freshmen during the FOCUS orientation program for new students each June. The students who were registered for the FOCUS sessions were separated from the automatic account process so they could be created in Google Apps initially. Documentation was added to our incoming students section of the IT website and distributed to the freshmen class during their orientation process. By timing the roll-out for students to begin during the orientation we were able to remove roughly 25% of the student body from the pool of students needing migration.

3.3 Upperclassmen Migration

Upperclassmen had only been able to access the web client for GroupWise, thus their use was considerably less than faculty / staff. Our initial migration utilities only copied mail; most

students didn't use the address book or calendar functionality of GroupWise. We opened the migration process in late July 2011 to all students at once, and then sent occasional reminders to those who had not yet migrated. Migration was complete in early October 2011; there were a couple hundred students who hadn't yet opted in to migration at that point, so we forced their migration at that time.

We experienced a large rush of students who started the migration process shortly after it was announced. During this rush we discovered that both Google and GroupWise have limits on the number of accounts that can go through the process at once. To address this issue, we created a wait queue that would start the next user once another person's migration was completed and limited the number of concurrent syncs to 20.

Once a student opted into the migration process, our utilities copied over mail at a rate of one message per second. Depending on the amount of mail in a student's account, this could take anywhere from a few minutes to many hours. They also were provided a login link to the new Gmail@Valpo account once they had begun the process, so they could immediately access their new account. During the time that messages were being copied from one system to another, students were able to login to both the GroupWise and Gmail@Valpo systems. This led to quite a bit of confusion, because students received mail in both accounts.

The migration process also required adjustments to our routing tables. The opt-in for migration was completed via an internal website, and this website was programmed to update routing and begin the message copying process at the same time. We learned that in the GroupWise system, when a person addressed a message, it would first look for a matching internal user and deliver the message to that account. Our routing tables properly updated to indicate that new incoming messages should be delivered to the Gmail@Valpo account, but this only applied to messages that did not originate from GroupWise. To address this we wrote additional scripts that would check address books throughout the GroupWise system and replace any user objects with the student's email address. We received many complaints from faculty, both officially and anecdotally, that their messages to students were never received during the migration. In 100% of the cases reported to us, the students did receive the messages but they were usually buried in a conversation that the students had not seen. Gmail by default turns on a feature called "conversation view," which threads all messages with matching subject lines together.

After the student's mail was migrated, they received an email at their new account indicating that all messages had been copied, and that they had 24 hours to notify the IT Help Desk of any problems. After the 24 hour period (which usually ended up being 48-72 hours), we deleted the student's GroupWise account. This then resolved the message delivery issue, because once a GroupWise account was deleted, all mail addressed to the student was correctly sent through the routing tables. We did receive some complaints from students claiming that they were not getting mail or that messages had not transferred but in each reported case they were either still in the migration process or were still using GroupWise and not checking Gmail for their new mail.

We did not provide any training to students on the new mail system, and did not receive any complaints. In our experience, students don't usually attend training classes and seem to be content with clicking around a service to learn it on their own.

Many students were already familiar with Gmail because of pre-existing personal accounts. The students therefore were up and running on the new system quickly. Even if students weren't familiar with Gmail specifically, most of them were familiar with web-based email systems such as Hotmail, Yahoo, or other services. The functions across many of these different systems are very similar; it's mainly the look & feel that is different between them.

3.4 Student Aides

Since students were migrated to Gmail before faculty and staff, they had no accounts left to use for accessing shared resources that remained in GroupWise. To solve this problem, we created generic accounts in GroupWise and provided the usernames and passwords to supervisors in the departments. They then provided the login information to their student aide employees so that they could login and access the shared resources. Faculty Advisors for student organizations were also given a temporary account to share with the student leadership until the resources could be migrated to Gmail.

4. PREPARATION FOR FACULTY / STAFF MIGRATION

4.1 Functionality Comparison

When comparing GroupWise to Gmail, there are far more similarities between their functionalities than differences however the differences are the only thing likely to be noticed by the end-user. The main functionality differences that we identified as cause for concern were:

- In GroupWise, you could open a message, view the properties, and see who had received/opened/deleted a message. In Gmail, you cannot view this type of information; the only option is to request a read receipt and be notified when a recipient opens a message.
- In GroupWise, you could share a folder within your account with other users. Gmail uses a label system instead of folders, so messages are in one repository and not separated out; therefore the only way to share messages is to share your entire account of messages with another user.
- In GroupWise, you could share a contact list with other users. Gmail does not have contact list sharing; they do offer the option to export a contact list, send to another user, and that user can import into his/her contact list.
- Google calendar functions and sharing are far superior to GroupWise as the Google system is more intuitive and easier to manage. Compatibility on mobile devices was more stable and user friendly with Google.

4.2 Meet & Greet Sessions

To communicate the upcoming transition period and address campus concerns IT hosted several "Meet & Greet" sessions to introduce the new Gmail@Valpo system to faculty and staff. In these sessions we outlined the migration process, addressed common concerns, and answered any questions they had. Four sessions were initially planned during the two weeks before semester break. The response to these sessions was overwhelmingly high and six more open sessions were scheduled in the first two weeks of the spring semester. At the request of the

Athletics department, we also scheduled two Meet & Greet sessions for them specifically later in the semester so the information was given closer to their actual migration. The first two sessions were advertised as being administratively focused and we personally invited every Administrative Assistant on campus to attend; the theory is that excited Administrative Assistants would be advocates for the change within their respective departments.

The fear of change was by far the biggest obstacle we faced in working with the faculty and staff. In this regard, the Meet & Greet sessions we held were the most valuable part of the entire process. Faculty and staff were able to come to a brief presentation where we provided a general overview of Google Apps, described the migration process, and answered questions they had. Those sessions felt more like counseling sessions, because we worked very hard to soothe people's fears and concerns. We know the Meet & Greet sessions didn't completely eliminate all fears, because we heard from many people after their migration who said, "Wow, that was a lot easier and less painful than I expected it to be!"

4.3 Meet & Greet Sessions – Major Topics

Many faculty and staff were initially worried about privacy of data and the security once their email was in "the cloud". Our contract with Google very explicitly states that they are required to abide by all laws protecting the privacy of student data, including FERPA and others. Google is not allowed to mine our data for the purpose of advertising.

One common issue we saw during the faculty and staff migration process was related to distribution lists in the GroupWise system. As individuals migrated over to Gmail@Valpo and their GroupWise accounts were deleted, their names also disappeared from internal GroupWise address books and distribution lists because these lists pointed to user objects instead of email addresses. This caused a few problems and complaints because faculty and staff were often unclear about which departments were migrating at different times. We created scripts to run within the GroupWise system so that when a user account was deleted, references to that user object in distribution lists and address books would be replaced with email address listings instead. We sent out campus-wide messages educating people on this issue and instructed them on what to do on their end to minimize the disruption. We also posted a Google calendar on our website showing when each department was migrating so that users could refer to the schedule and see when various users on their lists may be affected.

We used a pre-migration process which copied the majority of their mail to Gmail the week before their scheduled migration to limit the transition time; when the end-user "started" the migration process, they were already most of the way finished. The student process of 1-3 days and risking mail delivery at two separate systems was not an acceptable process for staff and faculty. Minimizing the loss of productivity due to down time was a major goal in adapting the process for faculty and staff.

We do assume that some productivity was lost due to this conversion, but how much is difficult to gauge. We designed the migration process for staff and faculty to enable them to immediately switch from one email system to another. The actual time on the day of migration averaged about five to ten minutes from the end-user perspective. Beyond that point, any lost time depended largely on how skilled the user was in Google

Apps and whether they had attended training sessions prior to migration. Quite a few users already had personal Gmail accounts, and had some level of familiarity with the service. This helped them to get up and running on their new Valpo account quickly, with confidence that they knew what they were doing. Other individuals didn't have any experience at all with Gmail, and had a steeper learning curve on the new system. Throughout the process we routinely heard that the training in advance of migration made everyone less apprehensive and allowed them to begin utilizing the new system quickly.

Within about a week of a user's migration date, they were technically able to login and access their account. If they attended one of our training sessions during that period they were able to login to their account. This allowed them to choose settings and preferences, start to feel comfortable navigating the service, and build their confidence. When the user actually migrated they had often been able to setup delegation, create their filters, and customize their account before they needed to use it. After their migration, these folks told us how much easier it was to adjust to using the new system because they were already familiar with it before they were forced to use it.

4.4 Department Meetings / IT Liaison

Each department had a specific member of the Google Project Team assigned as their primary liaison to help schedule and prepare the department for migration. We were able to meet with most departments as a whole shortly before their migration to remind them of the process and coordinate the timing of the migration day(s). Many departments were scheduled on a specific day and everyone migrated together whereas some of the larger departments (Dining Services, Facilities Management, Athletics, etc.) were migrated in smaller groups over the course of a week. The IT Help Desk was informed of the migration process and had been trained to assist with general questions, training, and migration assistance but adding a personal contact helped with communication and concerns specific to that particular department.

5. TECHNICAL PROCESS

5.1 Archives

Archives within GroupWise are stored locally on a machine, thus we were unable to transfer archives to their new Google account for end users automatically. There is a field set in eDirectory that will only have a value if a user has setup archives on their own as it is not setup by default. This gave us a list of the specific users that we needed to talk to about their archives. When asking if they used archives, we found many end-users believing that moving a message to a sub-folder was archiving the message. A large number of staff had clicked on archives at one point or another but never actually archived any messages. For those users with archives, we removed their quota within GroupWise and had them un-archive the messages so they were back on the server and could migrate through our process.

5.2 Pre-Migration

To help make the "migration" process look smoother to end users we added a "pre-migration" step to the process. Counting on the size of a user's mailbox and any other issues with an account that we would run into, the synchronization of an account could take over 24 hours. By "pre-migrating" users a few days before their

official migration we could make the migration process look almost instantaneous as there was significantly less mail to move.

During this process we also cleaned up any malformed or large emails in the user's account that could not migrate. We moved them into one of two folders within each user's GroupWise account: vuTooBig and vuMalformed. These folders were not included in the migration so the users could manually forward the messages, save the attachments, or opt to delete them. This greatly reduced productivity issues where individuals were waiting on their new account to finish migrating and reduced confusion about what account they should be using. We were also able to run several tests on their accounts during the pre-migration step to locate potential problems such as missing inboxes before the migration. The Google Team was alerted of the issue and that department's Liaison was able to address the issue with the end-user before it became a problem during the migration process.

5.3 Migration Process

On the designated day, each user was sent an email containing a link to an internal web form where they would verify the pre-migration folders, opt in/out of calendar and contact migration, and click to "start" the migration. Once the form was submitted their mail routing was set their gmail.valpo.edu destination. Routing tables were set to refresh every 15 minutes during the migration process to begin sending messages to the Gmail accounts quickly. We then migrated any new email that came in since the last pre-migration was run and migrated the user's calendar and contact information if they opted to have this done.

Once that was complete we sent an email to the user to verify everything was there and giving them a link to a second form to "finalize" the migration. Once the end-user had completed this step we deleted the GroupWise account. GroupWise account deletions were a manual process so our programmers kept watch during the days people were scheduled to migrate and deleted these as soon as they were approved for deletion by the end-user. As a precautionary measure, a final sync was performed before each deletion to ensure that the window of possibility between a GroupWise generated message being sent to their old account before it was deleted was reduced to under a minute.

5.4 Shared Resources

In GroupWise, shared resources were objects assigned to the ownership of users. Because of this setup, the shared resources couldn't be migrated using our back-end tools. Our first attempts to create rules in GroupWise to forward all messages from the resource to its Gmail location were very unsuccessful. In most instances, the rule would fail without indicating on which message. We could manually compare the messages in both accounts and then manually forward or print out the messages that didn't forward already, but that was exceptionally time consuming.

Our solution was to use Mozilla Thunderbird as an IMAP bridge in order to migrate the contents of these resources. We had several dummy GroupWise accounts, which could be set as the owner of the specific shared resource(s) we were trying to migrate. We could share folders from the dummy account to the resource and then move the messages into the shared folders, thus back into an account which could utilize IMAP. The dummy GroupWise account and the Google User Account were each connected via IMAP to Thunderbird where we could copy the messages from folder to folder. This process is admittedly convoluted so IT staff

handled this for the end users to reduce the potential for mistakes or confusion.

6. FACULTY / STAFF MIGRATION PROCESS

6.1 Department Recon

An important aspect of the migration process as a whole was to find out how users on campus were using GroupWise and the various features. We referred to this as reconnaissance (or “recon”). We didn’t want to “break” any departmental processes or workflows because of migration. We identified key contacts in each department on campus and focused our communication efforts with these people. In some departments, these contacts acted as an intermediary to pass information back and forth between the department staff and the IT staff. In other departments, these contacts were coordinators and communication happened via department-wide emails or meetings. The method utilized largely depended on the size of the department, since larger departments are harder to coordinate in the sense of scheduling face-to-face meetings.

We also created a Google Form to aid in collecting information about departments’ and individuals’ usage of GroupWise. The form asked which functions and features each person used, and was sent a week or two before migration. The form was most useful in larger departments so that we could reach more people in a shorter period of time. We were able to follow up with individuals who completed the form and ask for more information about the features they used. This helped us identify any unexpected uses as well as sharing between accounts and resources. The support on the day of migration was better tailored from the form responses since we knew who had a smartphone, who wanted mac documentation, who needed help sharing calendars, etc.

As part of this process, we were able to help provide users with instructions on how to use similar functionality in Gmail as well as advise them on which functions would not be available in Gmail. This applied mainly to shared folders, shared address books, and mobile device usage. We explained how sharing worked differently in Gmail versus GroupWise, and pointed them to tip sheets, help pages, and online instructions for accomplishing the same tasks in Gmail.

6.2 Pre-Migration

During the week prior to their official migration date, the pre-migration process ran behind the scenes. Most end-users were unaware of this process occurring unless something was identified that required the IT Liaison to follow up with an individual. One unexpected issue was a missing inbox. GroupWise allows the user to move their inbox folder into their cabinet, address book, calendar, etc. but still manages to deliver messages. Our migration utilities could not see the inbox once it was moved; the solution was simply to move it back and restart the pre-migration process.

6.3 Day of Migration Email

Each user was scheduled for a specific date to complete their migration. This date was determined through communication with contact person(s) in their department; in most cases, a single date was chosen for each department. On a department’s migration day, an email was automatically generated by our migration tools that would send a message to the user with a link to the online website to proceed with the migration process. The website had four pages

which provided instructions on each step. Each email was sent from Migration.Team@valpo.edu which was a Google group that informed the entire project team of any issues or replies.

6.4 Day of Migration Support

For most departments, IT staff was available on site at their location to assist with questions and issues as they arose while users were migrating. Many users were comfortable navigating through the process on their own, but for those who were less confident, we were able to provide support as they went through the steps.

Help Desk staff had all been trained in Google Apps and the migration process and were available for support through our regular channels (walk-ups, phone calls, emails, web tickets). Most Help Desk staff are students and had been using Gmail accounts for several months already as well, which gave them valuable experience and insight into using the system. They were well-equipped to provide support on the new email system.

For users unable to migrate the same day as their department, they could move forward with the process at any time they were ready. Once they had received the automated migration email, they could start when it was convenient for them. This was reassuring to users who were out of the office on their specified migration day.

For two departments, migration was scheduled differently due to the nature of their departments. Both Dining Services and Facilities Management are large groups of staff where they share computers among users, and the nature of their duties is not computer-based. For these groups, we scheduled specific migration sessions during two week timeframes chosen by their departments. The sessions were held in a computer classroom of the Library, and users signed up in advance for a session so that the number of users at any time was not more than the number of seats in the classroom. IT staff were available in the room at these sessions and assisted users with logging in and navigating through the migration process, as well as providing some basic training as they first logged into their accounts. We worked closely with each department to select session times that fit in with their departmental work schedules. This way we didn’t have sessions during their busiest times of day.

6.5 Shared Resources

Migration of messages within shared resources was mostly completed by IT staff, and therefore didn’t require much from the end user. We worked with users of shared resources to determine whether a Google Group or a full user account would be a better solution for their shared email needs. In the majority of cases, a full user account was preferable because of the ability to label messages, archive messages and grant delegated access to other users in the department. In a few cases, a Google Group was preferable because the department didn’t need the ability to manage messages, and only needed the ability for multiple users to receive messages. Temporary accounts were setup as was done with student access to shared resources previously until the resource could be manually moved by IT for the department. This allowed more flexibility in timing the moves with only a minimal amount of inconvenience during the transition.

6.6 Training

IT provided multiple training opportunities to make it more convenient for end users to take advantage. Users were strongly encouraged to participate in some sort of training to ease their

transition to the session. Many users did take advantage of the opportunity, and noted that training helped make it easier to switch from one system to another. Some users didn't take advantage of any training, and then complained about the transition being too difficult or confusing.

One method we used was traditional classroom-based training, where users were invited to attend a class with an IT trainer. This class covered the basic functions and uses of Google Apps including Gmail basics, the contact list, Calendar basics, and a brief overview of Docs. These classes were offered four times per week beginning in mid-January and going through mid-May. For at least two departments, training sessions were scheduled at a time of their choosing instead of our default scheduled times. If departments asked us, we did everything we could to accommodate their requests.

Another training class we offered biweekly was an open Q&A session, called "I've migrated to Gmail...now what do I do?" This session had no specified agenda, and was open to any person to bring any Google Apps questions at all. IT staff were available to assist them in solving their problem. These sessions were useful for individuals who may have spent time already in Gmail and needed answers to more advanced questions.

A third option available was the use of the lynda.com Online Training Library®. Valpo has a lyndaCampus site license, which allowed us to promote use of their existing Gmail courses as an option for our users. The lynda.com option was attractive to people who found it more difficult to carve out time for a 90 minute dedicated session, since the courses are all online and divided into smaller videos of between 2-7 minutes each. A user could go online anytime, whether on campus or off, and access the videos when it was convenient for them. They could also choose whether to view an entire course, or just the few segments that were most relevant to their needs.

6.7 Emeritus / Retired Staff

The deadline for finishing migrations as set by the CIO was April 15th for campus departments. We arranged to handle the migration of emeritus faculty and retired staff with computer access privileges and accounts after this date to enable more hands on assistance with these groups. We scheduled two open evening sessions for any emeritus / retired staff in the area and communicated the plans for migrating through ReVU, the retired faculty / staff social group. This was the first major system transition where the retired and emeritus staff were addressed as a user group specifically; the feedback from these end users was overwhelmingly positive.

6.8 Forced Migrations / GroupWise Shut Off

Despite our best efforts to get everyone to migrate, there were a couple hundred who did not start the migration or finalize the migration. We were able to schedule forced migrations for many of these stragglers and ran the process on a specific day without any interaction from them. The drawback to the force migration is that we didn't have any user authorization to delete the GroupWise account. Fortunately, we have not heard of any issues from this as most of the stragglers were adjunct faculty who infrequently used their Valpo accounts. Authentication to the GroupWise system was shut off on June 30th. IT staff retained access to finish moving a small amount of shared resources that had not yet been addressed.

7. CONCLUSIONS

7.1 Survey

We conducted a post migration survey among all faculty and staff that had gone through the process voluntarily. When asked how well would they rate their Gmail migration experience 36% indicated Good and 48% indicated Excellent. 82% of respondents agreed that Gmail was an improvement over GroupWise and 81% indicated they were either satisfied or very satisfied with Gmail as their email client.

We posed several open ended questions in the survey and learned that people felt we had provided more communication during this transition than with others. We also learned that people appreciated the variety of ways we used to communicate information about the changes. The Meet & Greet sessions were considered very helpful, as well as the regular email updates we sent to campus. We learned that in the future, we should do more individual meetings with departments to review how these changes affect their areas, since not everyone was able to attend a Meet & Greet.

7.2 General Conclusions

At the conclusion of the migration process the Google Project Team came to several conclusions as to the main items that made this migration such a resounding success.

- Pro-active communication prior to the migration is exceptionally useful in mitigating concerns and alleviating campus anxiety.
- A balance between continuously offered training and on the spot training is necessary.
- Liaisons enhance communication and set better expectations for the process. Departments know they have a specific person they can contact who is aware of their specific situations and needs.
- Scheduling departments instead of allowing them to go all at once was necessary to provide the on-site support on the day of migration.

Valparaiso University's experience migrating to the Google Apps for Education platform is one that any campus could replicate.

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