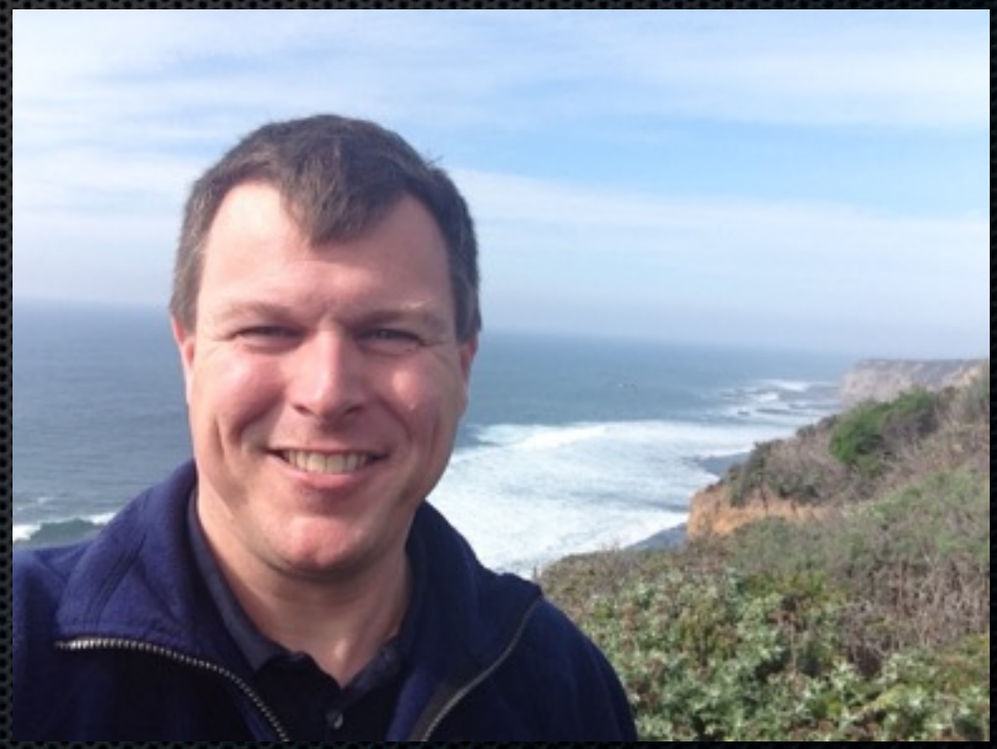
Andrew Urbaczewski

Andrew Urbaczewski is an Associate Professor and Chair of the Department of Business Information and Analytics in the Daniels College of Business at the University of Denver. He got his start managing Linux servers in 1996 while in graduate school, finding himself with more time than money. Now these servers are in the cloud and spun up as instances, but the IT strategies remain the same even as the technologies change.



When Andrew isn't at the terminal, you may find him on the golf course or with his daughter Hannah (studying Computer Science at the US Naval Academy) and son Colin (studying Mechanical Engineering at Michigan Tech).

Backing up Cloud Servers, and Remote Storage

What are we going to cover?

- Servers and Storage in the Cloud need backup
- Service provider backup is good, but you need more
- What types of backups?
  - work-in-progress
  - archiving closed dockets
  - real-time synchro for two live locations

Build vs. Buy

- rsync vs. …
  - Sync software (e.g., Synchronize Pro)
  - Time Machine
  - CrashPlan (and others)
- If off the shelf, use the off the shelf
- If needs to be customized, or you don't want the overhead of more software, then customize

Automation vs. User Interaction

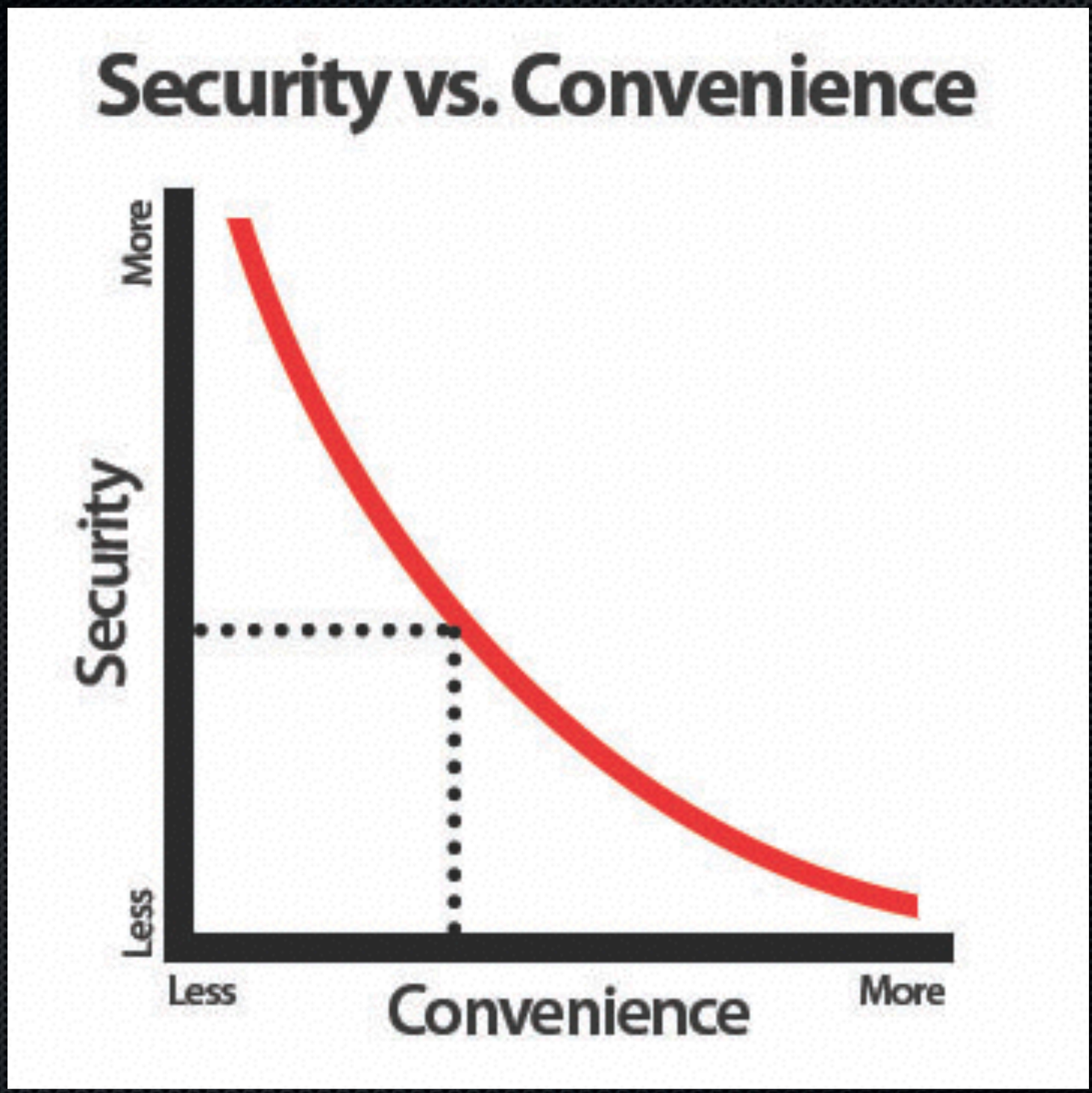
- Choose the level of automation vs. user interaction
  - Automatic: Cron/launchd
  - Convenient: Password-built-in applet
  - Security: Password-required applet

- How safe is your process from outsiders potentially disrupting or hijacking it?
  - Don't store passwords in clear text
  - Limit your backup servers to only allow specific IPs or users to send data to specific locations
  - Consider security at all times

Automation vs. User Interaction

- Automation comes with increased risk of…
  - Simple mistakes having dire side effects
  - Not noticing a problem
- User interaction has risk of people not doing what they committed to do
- Lesser of two evils; choose and manage

Security vs. Convenience



Command Line Primer

- Construction of a command:
  - command
  - options & switches
  - source and target
- Capitalization matters (case sensitivity)
- Read and understand the tools, using man pages
- Choice of editors don't insert unhelpful formatting
  - nano, vi, etc…
- Version and compatibility of tools

rsync

- Does a "differential" backup where only the chunks of files that are different are transferred
- Extremely efficient for copying large trees of files when only a few modifications have been made
- Not generally more effective for binary files such as DMGs, zip files, etc, because these tend to change the entire file if something inside is different
- Works locally and to remote servers (can work over SSH if remote server doesn't have rsync installed)

rsync in OS X

- Default OS X version old and deprecated: 2.6.9
- Current rsync version is 3.1.2
- As of 10.11 El Capitan, /usr/bin/rsync cannot be replaced or modified (due to SIP)
  - … and it's still 2.6.9

Obtaining Updated rsync

- Download new rsync to /usr/local/bin/rsync:

```
curl -O http://rsync.samba.org/ftp/rsync/
rsync-3.1.2.tar.gz
tar -xzvf rsync-3.1.2.tar.gz
rm rsync-3.1.2.tar.gz
cd rsync-3.1.2
./prepare-source
./configure
make
sudo make install
```

- Compare:

```
/usr/local/bin/rsync --version
/usr/bin/rsync --version
```

man rsync

```
NAME
   rsync - faster, flexible replacement for rcp

SYNOPSIS
   rsync [OPTION]... SRC [SRC]... DEST
   rsync [OPTION]... SRC [SRC]... [USER@]HOST:DEST
   rsync [OPTION]... SRC [SRC]... [USER@]HOST::DEST
   rsync [OPTION]... SRC [SRC]... rsync://[USER@]HOST[:PORT]/DEST
   rsync [OPTION]... SRC
   rsync [OPTION]... [USER@]HOST:SRC [DEST]
   rsync [OPTION]... [USER@]HOST::SRC [DEST]
   rsync [OPTION]... rsync://[USER@]HOST[:PORT]/SRC [DEST]
```

Common rsync options

- `-P`: show partial progress bar
- `-h`: human-readable numbers
- `-a`: "archive" mode copies nearly everything as-is
- `-v`: verbosity
- `-z`: compression
- `rsync -Phavz source dest`
  - Shows progress, human readable file sizes, copies mostly everything, shows every file being copied, and compresses for lower bandwidth

Basic rsync usage

- `rsync -a SOURCE DESTINATION`
- `rsync -a /path/to/source /path/to/dest`
  - Will copy the folder "source" to "dest"
- `rsync -a source username@destination:/path/to/server/folder/`

Classic rsync

- Copy content of "files" to destination on server:

```
rsync -avz  /path/to/files/  user:password-
if-you-want-saved@host:/path/to/target/
```

- Copy folder "source" to server as "dest", showing progress in human readable format:

```
rsync -Phavz /path/to/source user@host:/path/
to/dest
```

Power of Script

- The real power comes with stringing multiple commands together
  - Allows for no dark-time between task 1 completing and the beginning of task 2
  - Allows for the accurate repetition of task n, for as many boring times as you need it to be done

Reminder: Good Habits

- When scripting, use some form of version mgmt
  - name/number your scripts as you develop them
  - keeping light notes about what each version adds
  - source control - upload to GitHub or BitBucket
- Output should help you track
  - have your script create embed a header line in any output files, quoting the script version
- Alternatively … Breadcrumbs
  - Have scripts create (or check for, causing different outcomes) hidden 'breadcrumb' files (empty, but fixed name starts with a period)

Reminder: Good Habits

- Add or change as few things as possible (1 or 2) when editing or building a script, lest you break A while building B
- Consider embedding occasional screen output lines through your script, to provide some feedback if your script hangs or fails midway through
- Use version/source control frequently so you can always revert to previous revisions, especially if making big changes

“touch”

- `touch /path/of/interest/.last_rsync_time`
  - Will either create (or modify the last modified time stamp on) a file
  - Can be used to mark files to backup on next run

Choices

- When choosing how to best protect the source data, consider the behavior of it.
  - How fast does it change, vs. how long do you need it to stay still?
  - It's not about backup, it's about restore
    - Is the restore accurate and useable

Think Photo

- You want to create a perfect “image” of the dataset
- Think about a photograph of a large, active park
  - While you use iPhone’s panoramic panning, people walk in the direction of your pan.
    - you now end up with the same person in the picture 3 or 4 times
    - if walking the other way, you might end up with just a partial, unrecognizable blur

Files Blur Too

- Same with live files such as:
  - large PST file or database
  - log files
  - large media file
- If the index to captured at block 1 is out of date before you're at block n, the restored file may not work
- Solution: always use application-aware tools or commands to 'dump' a database or shadow file, then backup that flat / static file.

Real Examples

- MySQL / PostgreSQL is a good example of this “blur”
- Live log files are another example
- Backups like CrashPlan, Time Machine, or sync applications won’t handle properly

MySQL: Backing it up

Backup every day, keep for a week

```
#!/bin/bash

# Clean up older backups, anything older than 7 days
find /Users/backup/ -mtime +7 -delete

# Get all databases
DUMPNAME=/Users/backup/fulldump-`date "+%Y%m%d"`.sql
/usr/bin/mysqldump -u root --
password="paswordgoeshere" --all-databases > $
{DUMPNAME}
ln -sf ${DUMPNAME} /Users/backup/latest-fulldump.sql
```

And, the rest of the site?

```
# Get the site
SITENAME=/Users/backup/www_site-`date "+%Y%m
%d"`.tar.gz
tar czvf ${SITENAME} /Library/WebServer/Documents/
db.companydomain.com
ln -sf ${SITENAME} /Users/backup/latest-site.tar.gz

# Get local configs
USRLOCALNAME=/backup/usr_local-`date "+%Y%m%d"`.tar.gz
tar czvf ${USRLOCALNAME} /usr/local
ln -sf ${USRLOCALNAME} /backup/latest-usrlocal.tar.gz
```

Behavior at Both Ends

- Identifying the desired behavior at the source … and the target
  - Example: Move the daily backups to a weekly set
- Use pattern (regex) matching and how to select the right source data
- Beware of the rogue loop with the best of intentions but the simplest of syntax errors
- Test regex filter syntax in a non-destructive way

Moving Data

- You may want to script moving data at source, or destination
  - Example: Move some data in a source path, while leaving others (move out files older than 30 days)
- Do you want to MOVE files (remove from source) vs. COPY (leave at source)?
- Do you want to segregate or notate files at the source, if choosing to leave them on the volume (move into a ‘processed’ folder, or change filename)?

Example: Moving Older Files

Moving files that are more than 180 days (only) from one location to another.

```
# Create list of affected files -- find all the
files that are 180 days ago or more
$ find . -type f -ctime +180 -print > ${TMPLIST}

# Sync to the other box (need to define variables)
#   {EXCH_USER}  ${EXCH_HOST}   ${TARGET_DIR}
$ rsync -avz --files-from=${TMPLIST} ./ $
{EXCH_USER}@${EXCH_HOST}:${TARGET_DIR}/

# Delete after successful sync
# Dangerous -- be careful
$ cat ${TMPLIST}|xargs rm -f
```

rsync's Clean Up Flags

Another way to do the clean up is to use rsync's built-in clean up flags such as:

```
-e  flags of interest...
    --remove-source-files   sender removes synchronized files (non-dir)
    --delete                delete extraneous files from dest dirs
    --delete-before         receiver deletes before transfer (default)
    --delete-during         receiver deletes during xfer, not before
    --delete-after          receiver deletes after transfer, not before
    --delete-excluded       also delete excluded files from dest dirs
```

rsync's Clean Up Flags

So, if you want to move backups from one machine to another, you might do:

```
rsync -avz -e --remove-source-files  --delete-after
/path/to/backupfiles    user:password-if-you-want-it-
saved@host:/path/to/targetbackupfiles
```

Excluding Files

- Sometimes, there are files you don't want:
  - OS Specific files (e.g., `.DS_STORE`)
  - Installation specific (e.g., configuration paths)
  - Temp or Cache files
  - Source control files (.git, .hg)
- rsync flags to the rescue, exclude any file with 'dir1':

  ```
  rsync --exclude 'dir1'
  ```
- 6 rsync Examples to Exclude Files and Folders

  `http://www.thegeekstuff.com/2011/01/rsync-exclude-files-and-folders/`

Additional Considerations

- Outcome / confirmation and documentation of a script's completion
- Add logging?
- Do you want to append a date/time stamped summary line to a fixed-path log file?
- Add reporting or notification?
- Do you want the script to email you?

Real Examples

- Kerio Example:
  - Backing up a live server
  - Having an easy fail over, albeit manual
- Web Server (e.g., WordPress)
  - Backing up a live server
  - Database, Files, Config

Scripting the Total Solution

- Automating rsync and mysql
- Scheduling (cron or whatever)
- Logs
- Notifications and issues
- Email a report

Trust and Verify

- Now that you've built a script or application to move the data, you're not wrong to want to trust it. That's not a bad thing - but trust AND VERIFY.
- Take the time for periodic validation that you can successfully recover from the hypothetical threat that you seek protection from
  - Establish what 'normal' behavior looks like (time to run, size of output, etc.) and determine how you'll detect off-nominal developments
  - TEST A FULL RESTORE!

Test, before going live

- Test regex filter syntax in a non-destructive way
- Regex Testing Tools
  - http://regexr.com
  - http://ryanswanson.com/regexp/#start
  - http://www.regexpal.com
- Additional Regex tools:
  - http://www.cheatography.com/davechild/cheat-sheets/regular-expressions/
  - http://regexlib.com/CheatSheet.aspx
  - http://www.virtuosimedia.com/dev/php/37-tested-php-perl-and-javascript-regular-expressions
  - http://code.tutsplus.com/tutorials/8-regular-expressions-you-should-know--net-6149

Incremental and Differential

- Incremental
  - Monday: Full backup
  - Tuesday: backs up changes between Mon and T
  - Wed: backs up changes between T and W
  - Thurs: backs up changes between W and Th.
- Differential
  - Monday: Full
  - Tues: backs up changes between M and T
  - Wed: backs up changes between M and W
  - Thur: backs up changes between M and Th.

Incremental vs. Differential

- Incremental allows one restore from the date of latest incremental to get everything.
- Differential requires you restore Monday then Tues then Wed then Thurs.

Questions?

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MACTECH PRO EVENTS