USE OF THE CLOUD FOR MT

Replacing pesky humans with robots!





National Geoelectromagnetic Facility





Driving Question

How can the "Cloud" improve process flow and minimize impacts on field operations due to failures in data transportation?





Data Workflow – Prior to Cloud storage



IRISDMC





Data Workflow – Using the Cloud



IRISDMC

MT Data Workflow

Data Transmission and Quality Control Process – KISS

- Our field crews are heterogeneous so we keep things simple and automated
- Instrument control is through easy to use LabView interface



MT Data Workflow

During site visits, the field process the MT data in the field using a single station robust processing algorithm. This lets the field crew know, at the field site, if the data quality has met requirements, or if the site needs reconfiguration and if an additional data run is required

✓ Verify Site Meta Data – □ ×	MBB03d.zss (XY=B; YX=R)
Run ID MBB03d Site Name Braden, Missouri, MO, USA	Eile Edit View Insert Tools Desktop Window Help Plot Options Print \checkmark D \cong \bigoplus \bigoplus \bigotimes \bigoplus \bigotimes \bigoplus
GPS OK START (GMT): Date 2009-04-15 Time 17:01:14 _edit END (GMT): Date 2010-02-27 Time 17:30:52 LAT 37.0289 LON -93.0241 ELEV 373.7 DECL 2 HEADER PRESENT Ex: length 230.9 Azimuth 0 Electrodes 1; 2 Ey: length 298.2 Azimuth 90 Electrodes 3; 4 NIMS ID 2611-B4 Magnetometer 2611-B4 Cain L	HBB03d.zss (XY-B; YX-R)
NIMS Comments deal Station!! No more cows, Site looks good, Run started at noon Central Time on Tax day, Low Additional Comments	10 ¹ 10 ² 10 ³ 10 ⁴ 10 ⁵ 90 75 0 8 45 90 90 90 90 90 90 90 90 90 90
Site Installed By Meta Data Checked By Tristan Peery Tristan Peery; Adam Schultz; Anna Kelbert OK RESTORE PLOT PROCESS	$15 \\ 0 \\ 10^{1} \\ 10^{2} \\ 10^{3} \\ 10^{4} \\ 10^{5} \\ 10^{5} \\ 10^{4} \\ 10^{5} \\ 1$





Why Dropbox? (we're agnostic about which Cloud service; for now this one works well, but we can easily switch)



- Robust servers
- File deletion protection
- Versioning controls
- Dropbox software verifies file integrity
- Robust against often slow hotel/MiFi internet connections





NGF MT Repository

2 x Synology RX1214 NAS + expansion

- 2 x 24 Enterprise Class 4 TB HD (~2 x 96 TB of capacity)
- RAID 6, 1 hot swap drive per rack, 4 racks
- automatic sync across NAS's triggered by any file updates
- compilation of software available to run based on our needs.
 - Service tickets
 - Inventory control
 - Cloud server











Real life example – recovery from total disaster

- ~6 Enterprise class 4 TB hard drive failures
- Complete control hardware failure









Real life example – recovery from total disaster

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100% data recovery







Standard Database Schema Across Projects

Folders	Folders	Folders	Folders
imush 🕨	📄 Collaborative-Workspace 🔹 🕨	📄 field-data 🔹	C010
	Combined-MT-Datasets	📄 site-informatnotes-photos 🕨	C011
	daily-production-reports	site-visit-reports	C012
	📃 data-qc-analysis 🔹 🕨	siting-permitting	C013
	📃 dynamic-survey-map 🛛 🕨	transfer-functions	C014
	processing		D010 ►
	📃 stations 🔹 🕨		D011 ►
			E010
			E011
			E012
			E013
			E014
Can this be gener	alized so all project	s can be provided	► F010
pro-populated templates + Cloud so manual "uploads"		■ F011	
pre-populated templates - cloud so manual uploads		► F012	
To DMC can be eli	iminated?		► F013
			► F013-5

- Field Data
- Pictures
- Site visit reports

- Daily Production Reports
- Permits
- Maps





Local Disaster Protection



- Amazon Glacier
 - Low-cost cloud archiving
 - Built for large storage
 - Optimized for infrequently accessed data
 - Retrieval time is several hours





Summary and Future Work

- Data management: move from obtuse/time consuming to robust procedures
- Remove human error portion, automation!
- Standardization of procedures across projects
- Future Work:
 - Move away from Dropbox, onto alternative clouds or Synology cloud software
 - Develop systems to upload directly to cloud storage
 - Develop cloud based software: inventory control, service tickets, etc.





