Reimagining datalogger monitoring and computer systems at the Alaska Earthquake Center

Alexandra Farrell

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Antelope User Group Meeting

akfarrell@alaska.edu

UAF UNIVERSITY OF ALASKA FAIRBANKS ALASKA EARTHQUAKE CENTER

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Alaska Earthquake Center (AEC)

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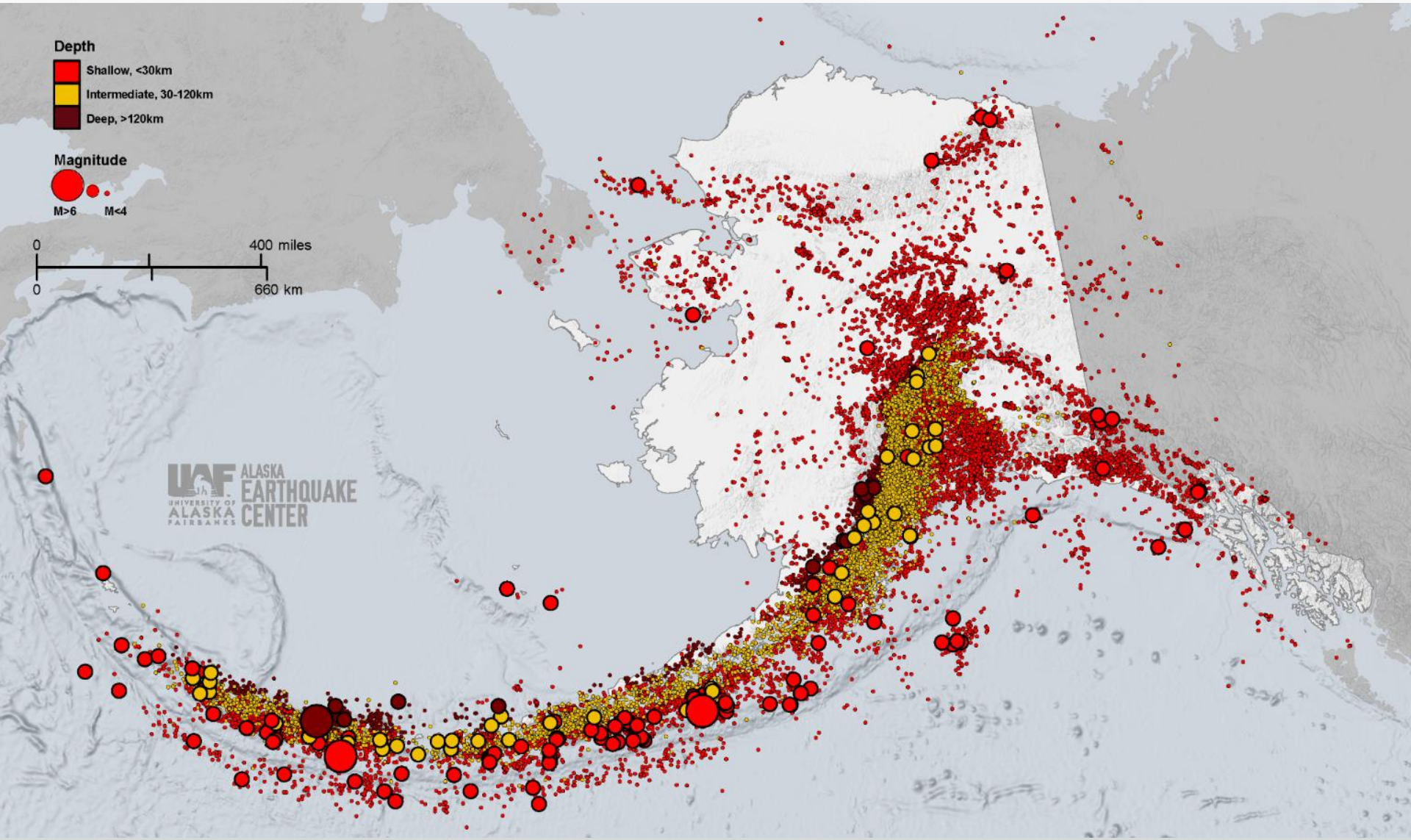
2023 Earthquake Summary



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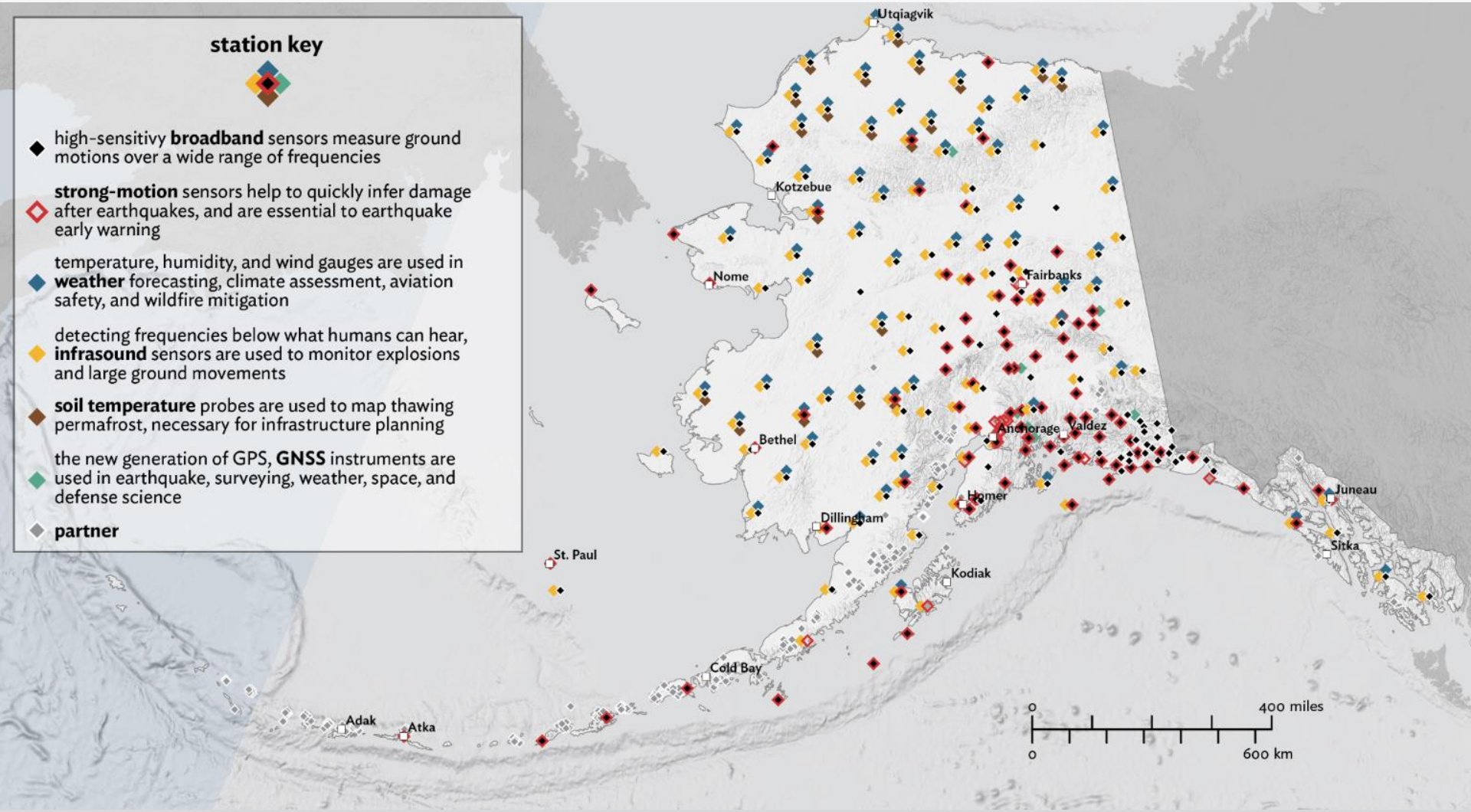
AEC stations



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Part 1: Reimagining Datalogger Monitoring

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Introducing Webdlmon

Web-based Datalogger Monitoring for the Alaska Earthquake Center

Last refresh: 5 seconds ago

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Usage

- Duty: check to see status of station for pipeline alarms
- QC: check to see timing issues, mass positions, latencies, datalogger reboots, gaps, etc.
- Field: check to confirm station status (network connection) and key telemetry/power diagnostics during fieldwork.
- Network monitoring: the starting point to detect network and station problems and is very useful for daily network checks.

Overview

Web-based Datalogger Monitoring for the Alaska Earthquake Center

Last refresh: 8 seconds ago

Search Station name: Search for names..

☑ Status ☑ DL Type ☑ Latency ☑ Runtime ☑ Throughput ☑ Data Rate ☑ Buffer ☑ Comm Efficiency ☑ Temp ☑ Voltage ☑ Current ☑ Mass Position 0 ☑ Mass Position 1
☑ Mass Position 2 ☑ Mass Position 3 ☑ Mass Position 4 ☑ Mass Position 5 ☑ Clock Latency ☑ GPS Status ☑ Clock Status ☑ Clock Quality ☑ Data Gaps ☑ Reboots ☑ Link Cycles

DL Name	Status	DL Type	Latency	Runtime	Throughput	Data Rate	Buffer	Comm Efficiency	Temp	Voltage	Current	Mass Position 0	Mass Position 1	Mass Position 2	Mass Position 3
AK_A19K	offline	q330	6h-22m	6h-20m	0	0	0	100	3	13.35	0	4	-22	14	20
AK_A21K	offline	q330	1Y-9M-6D	1Y-9M-6D	0	0									
AK_A22K	offline	q330	57m-8s	55m-11s	0	8	0	100	18	13.5	0	3	-3	-12	20
AK_ATKA	online	q330	34s	29m-57s	1.041	4307	0	100	11	13.35	0	33	33	33	-7
AK_B18K	offline	q330	5h-52m	5h-50m	0	0	0	98.889	1	13.2	0	-12	5	1	
AK_B20K	online	q330	36s	3h-13m	1.074	4010	0	100	18	13.5	0	-11	8	-4	
AK_B22K	offline	q330	10M-1D	10M-1D	0	0									
AK_BAE	offline	q330	23D-3h	23D-3h	0	16	0	100	6	13.35	0	34	33	33	-1
AK_BAGL	offline	q330	5M-8D	5M-8D	0	0	0	100	0	12.75	0	20	20	20	7
AK_BAL	online	q330	12s	30m-4s	1.107	3402	0	100	9	13.2	0	20	20	20	-1
AK_BARK	offline	q330	5M-8D	5M-8D	0	0	0	81.967	3	11.7	0	20	20	20	9
AK_BARN	online	q330	14s	6m-0s	1.008	2253	0	100	11	13.65	0	20	20	20	5

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Legend

Jump To Top

Legend

DL Name

Description: Name of station

Status

Description: Overall health of data logger

Coloring and Status Descriptions:

- stopped = - Server stopped (offline)
- yes = - Currently connected and acquiring data (online)
- waiting = - Waiting for a datalogger POC (listening)
- hibernating = - Hibernating (offline)
- sleeping = - Sleeping after a connection setup failure (offline)
- reg = - Establishing a connection (offline)
- su = - Establishing a connection (offline)
- nr = - NULL datalogger ip-address (offline)

DL Type

Description: Data logger type

Latency

Description: Age of last data packet sample recieved.

Units: Day, Hr, Min, Sec

Coloring:

- 0 - 60 =

Hide Columns

Web-based Datalogger Monitoring for the Alaska Earthquake Center

Last refresh: 2 seconds ago

Search Station name: Search for names..

☑ Status ☑ DL Type ☑ Latency ☑ Runtime ☑ Throughput ☑ Data Rate ☐ Buffer ☐ Comm Efficiency ☑ Temp ☑ Voltage ☑ Current ☑ Mass Position 0 ☑ Mass Position 1

☑ Mass Position 2 ☑ Mass Position 3 ☑ Mass Position 4 ☑ Mass Position 5 ☑ Clock Latency ☑ GPS Status ☑ Clock Status ☑ Clock Quality ☑ Data Gaps ☑ Reboots ☑ Link Cycles

DL Name	Status	DL Type	Latency	Runtime	Throughput	Data Rate	Temp	Voltage	Current	Mass Position 0	Mass Position 1	Mass Position 2	Mass Position 3	Mass Position 4	Mass Position 5
AK_A19K	offline	q330	6h-22m	6h-20m	0	0	3	13.35	0	4	-22	14	20	21	21
AK_A21K	offline	q330	1Y-9M-6D	1Y-9M-6D	0	0									
AK_A22K	offline	q330	57m-8s	55m-11s	0	8	18	13.5	0	3	-3	-12	20	20	20
AK_ATKA	online	q330	34s	29m-57s	1.041	4307	11	13.35	0	33	33	33	-7	-10	-4
AK_B18K	offline	q330	5h-52m	5h-50m	0	0	1	13.2	0	-12	5	1			
AK_B20K	online	q330	36s	3h-13m	1.074	4010	18	13.5	0	-11	8	-4			
AK_B22K	offline	q330	10M-1D	10M-1D	0	0									
AK_BAE	offline	q330	23D-3h	23D-3h	0	16	6	13.35	0	34	33	33	-1	3	2
AK_BAGL	offline	q330	5M-8D	5M-8D	0	0	0	12.75	0	20	20	20	7	-14	1
AK_BAL	online	q330	12s	30m-4s	1.107	3402	9	13.2	0	20	20	20	-1	1	2
AK_BARK	offline	q330	5M-8D	5M-8D	0	0	3	11.7	0	20	20	20	9	-15	7
AK_BARN	online	q330	14s	6m-0s	1.008	2253	11	13.65	0	20	20	20	5	-5	5

Station Search

Web-based Datalogger Monitoring for the Alaska Earthquake Center

Last refresh: 18 seconds ago

Search Station name: FA

Status | DL Type | Latency | Runtime | Throughput | Data Rate | Buffer | Comm Efficiency | Temp | Voltage | Current | Mass Position 0 | Mass Position 1 | Mass Position 2 | Mass Position 3 | Mass Position 4 | Mass Position 5 | Clock Latency | GPS Status | Clock Status | Clock Quality | Data Gaps | Reboots | Link Cycles

DL Name	Status	DL Type	Latency	Runtime	Throughput	Data Rate	Buffer	Comm Efficiency	Temp	Voltage	Current	Mass Position 0	Mass Position 1	Mass Position 2	Mass Position 3	Mass Position 4
AK_FA01	online	q330	22s	12m-34s	1.05	6230	0	100	5	11.55	0	41	41	41	20	20
AK_FA02	online	q330	17s	53m-15s	1.041	8254	0	97.949	31	13.5	0	41	41	41		
AK_FA10	online	q330	32s	47m-24s	0.793	6425	0	99.625	41	11.7	0	41	41	41	20	20
AK_FALS	online	q330	19s	21m-38s	0.86	4944	0	100	13	13.2	0	50	51	51	2	2
AK_FA05	online	Etna 2	7s	13D-22h					38	13.163	0					
AK_FA06	online	Etna 2	3s	13D-22h					36	13.224	0					
AK_FA07	online	Etna 2	9s	13D-22h					35	13.253	0					
AK_FA12	online	Etna 2	9s	13D-22h					34	13.136	0					

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Color Blind Friendly Table

Search Station name: Search for names..

Status | DL Type | Latency | Runtime | Throughput | Data Rate | Buffer | Comm Efficiency | Temp | Voltage | Current | Mass Position 0 | Mass Position 1

Mass Position 2 | Mass Position 3 | Mass Position 4 | Mass Position 5 | Clock Latency | GPS Status | Clock Status | Clock Quality | Data Gaps | Reboots | Link Cycles

DL Name	Status	DL Type	Latency	Runtime	Throughput	Data Rate	Buffer	Comm Efficiency	Temp	Voltage	Current	Mass Position 0	Mass Position 1	Mass Position 2	Mass Position 3
AK_A19K	offline	q330	6h-23m	6h-21m	0	0	0	100	3	13.35	0	4	-22	14	20
AK_A21K	offline	q330	1Y-9M-6D	1Y-9M-6D	0	0									
AK_A22K	offline	q330	58m-8s	56m-11s	0	0	0	100	18	13.5	0	3	-3	-12	20
AK_ATKA	online	q330	31s	30m-57s	1.041	4342	0	100	11	13.35	0	33	33	33	-7
AK_B18K	offline	q330	5h-53m	5h-51m	0	0	0	98.889	1	13.2	0	-12	5	1	
AK_B20K	online	q330	36s	3h-14m	0.942	4208	0	99.254	18	13.65	0	-11	8	-4	
AK_B22K	offline	q330	10M-1D	10M-1D	0	0									
AK_BAE	offline	q330	23D-3h	23D-3h	0	0	0	100	6	13.35	0	34	33	33	-1

Color Blind Friendly Legend

Jump To Top

Legend

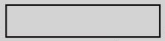
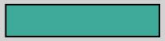
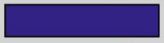
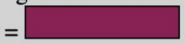
DL Name

Description: Name of station

Status

Description: Overall health of data logger

Coloring and Status Descriptions:

- stopped =  - Server stopped (offline)
- yes =  - Currently connected and acquiring data (online)
- waiting =  - Waiting for a datalogger POC (listening)
- hibernating =  - Hibernating (offline)
- sleeping =  - Sleeping after a connection setup failure (offline)
- reg =  - Establishing a connection (offline)
- su =  - Establishing a connection (offline)
- nr =  - NULL datalogger ip-address (offline)

DL Type

Description: Data logger type

Latency

Description: Age of last data packet sample recieved.

Units: Day, Hr, Min, Sec

Coloring:

- 0 - 60 = 

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Sort by Column

DL Name	Status	DL Type	Latency	Runtime	Throughput	Data Rate	Buffer	Comm Efficiency
AK_CDVT	online	Basalt	5s	3D-12h				
AK_DAM2	online	Basalt	29s	13D-22h				
AK_K204	online	Basalt	30s	13D-22h				
AK_K205	online	Basalt	23s	13D-22h				
AK_K208	online	Basalt	16s	1M-12D				
AK_K210	online	Basalt	1m-16s	13D-22h				
AK_K211	online	Basalt	2s	20D-9h				

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Reverse Sort by Column

☑ Status ☑ DL Type ☑ Latency ☑ Runtime ☑ Throughput ☑ Data Rate ☑ Buffer ☑ Comm Efficiency ☑ Temp ☑ Volta

☑ Mass Position 2 ☑ Mass Position 3 ☑ Mass Position 4 ☑ Mass Position 5 ☑ Clock Latency ☑ GPS Status ☑ Clock Status

DL Name	Status	DL Type ▲	Latency	Runtime	Throughput	Data Rate	Buffer	Comm Efficiency	Temp
AK_K209	online	Rock	42s	2Y-0m-6D					31
AK_K213	online	Rock	18s	11M-24D					33
AK_K215	online	Rock	5s	1M-12D					29
AK_K217	online	Rock	2s	2Y-0m-1D					27
AK_K218	online	Rock	29s	13D-20h					26
AK-ANM	online	Q8	12s	2M-25D					22
AK-CCB	online	Q8	43s	11M-7D					42

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Headers Pinned

DL Name	Data Rate	Buffer	Comm Efficiency	Temp	Voltage	Current	Mass Position 0	Mass Position 1	Mass Position 2	Mass Position 3	Mass Position 4	Mass Position 5	Clock Latency	GPS Status
AK_K209				31	15.43	0								
AK_K20K	3379	0	98.519	29	12.75	0	2	2	-1				0s	
AK_K210				26	15.517	0								
AK_K211				25	15.507	0							0s	
AK_K212				25	15.528	0							0s	
AK_K213				33	15.44	0								
AK_K214				36	15.277	0							7s	
AK_K215				29	15.5	0								
AK_K217				27	15.44	0								
AK_K218				26	15.49	0								
AK_K221				35	14.099	0							7s	
AK_K222				21	13.124	0							6s	
AK_K223				35	13.314	0							5s	
AK_K24K	5229	0	100	29	13.05	0	-14	-7	4				0s	

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Information Pop-up

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Map

Jump To Legend

View Map

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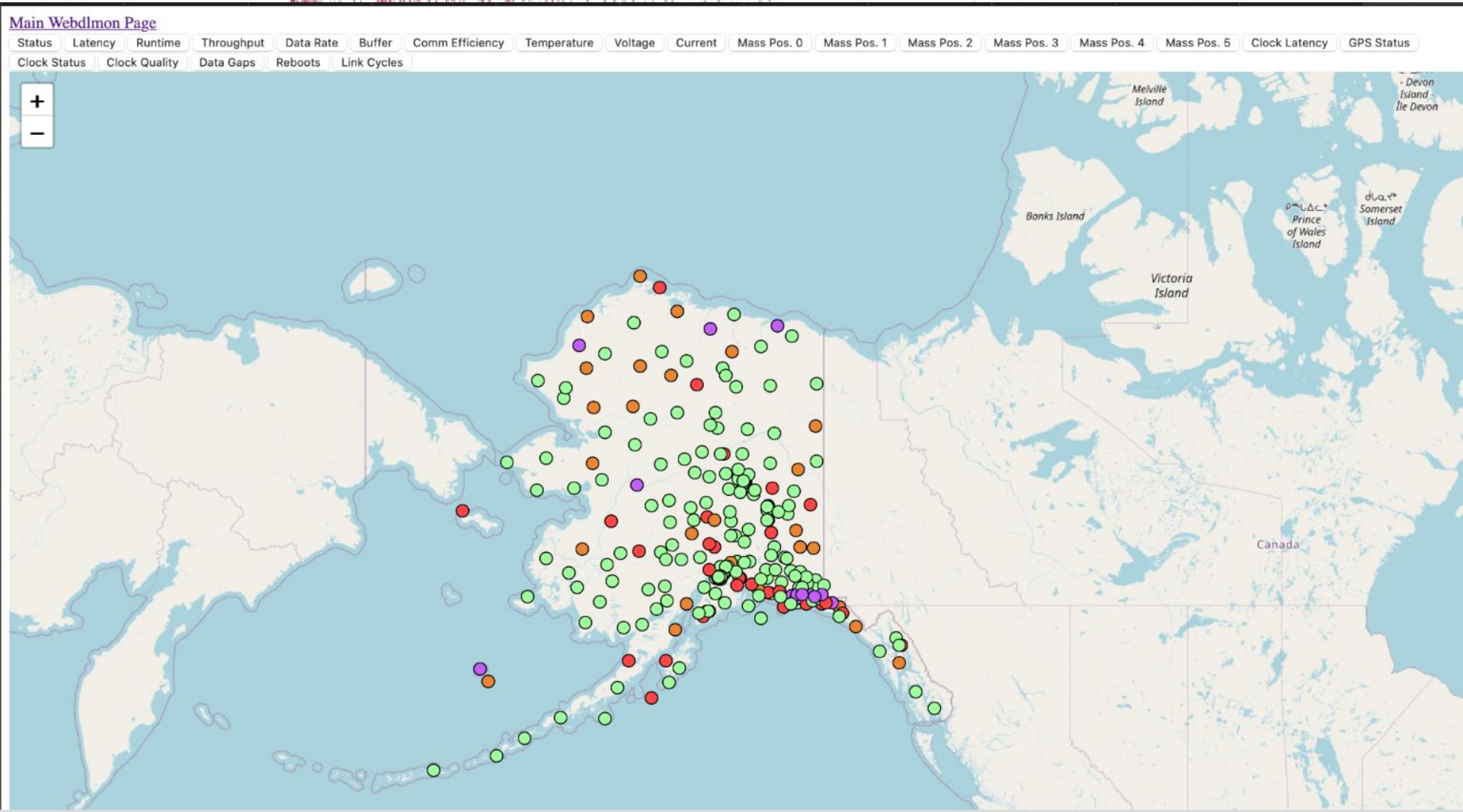
Map View



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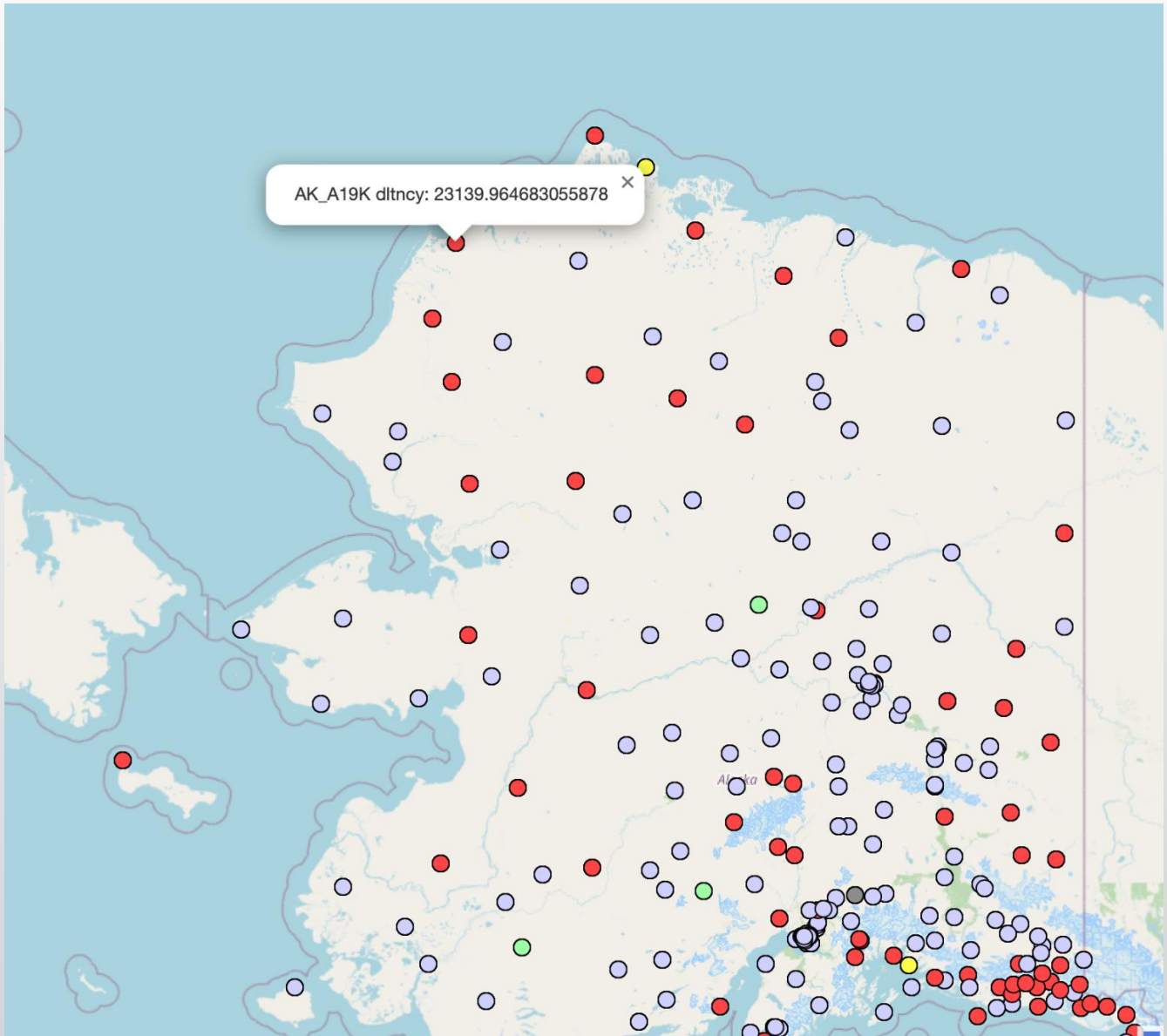
Basic Information on Click



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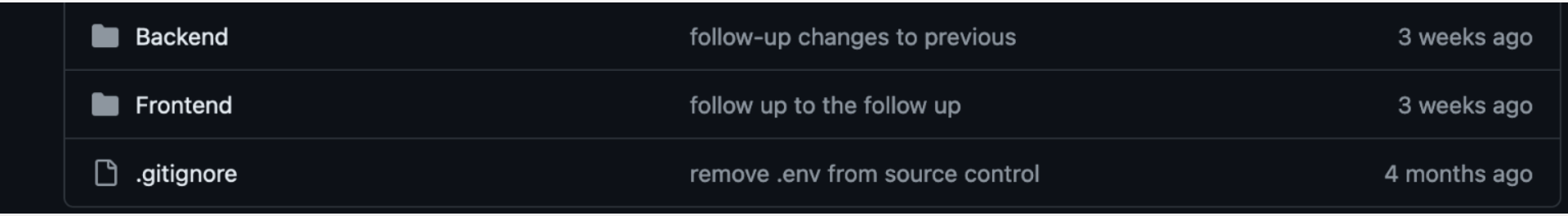
Codebase



- DOM (document object module) - representation of the HTML
- React.js can refresh certain parts of the DOM without refreshing the whole DOM or page

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Workflow

- Python script running as rtexec process captures SOH packets from our primary data ORB
  - packet_types = ('.*/pf/st', 'AK_GRE.*_D0/SEED')
- Writes data to MySQL database
  - database holds current data, not record through time
- Website backend queries MySQL database and puts data into a JSON file
  - also sends an epoch time of creation to the frontend
- Website frontend handles user requests and displays the data
  - takes epoch from backend and determines how old that epoch is in seconds
  - also does some math for latency when no new data has been received
  - refreshes every cell in table

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Map Codebase

getColor.js	brought things up to speed with main webdlmon	3 weeks ago
index.html	improved code style and added an auto-update at 5sec ...	2 months ago
map.js	brought things up to speed with main webdlmon	3 weeks ago
style.css	adding files - site nearly complete	2 months ago
webdlmon.json	adding files - site nearly complete	2 months ago

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Challenges

- Standardizing for all datalogger types in use
  - which metrics to use
  - unit conversions for values
- Packet ingestion control
  - for Centaur packets
- Formatting tweaks
  - allow usability for all users as well as mobile platforms
  - time/date format for readability

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Part 2: Reimagining Computer Systems

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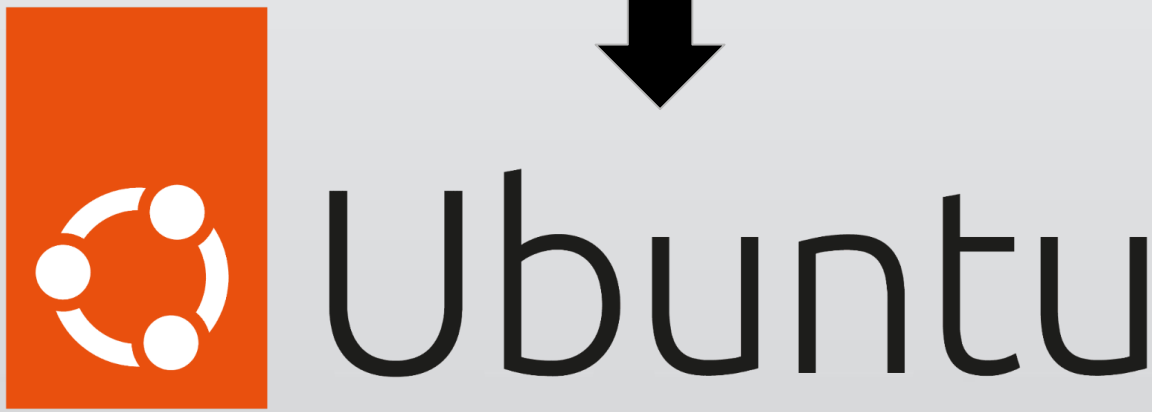
Major Change



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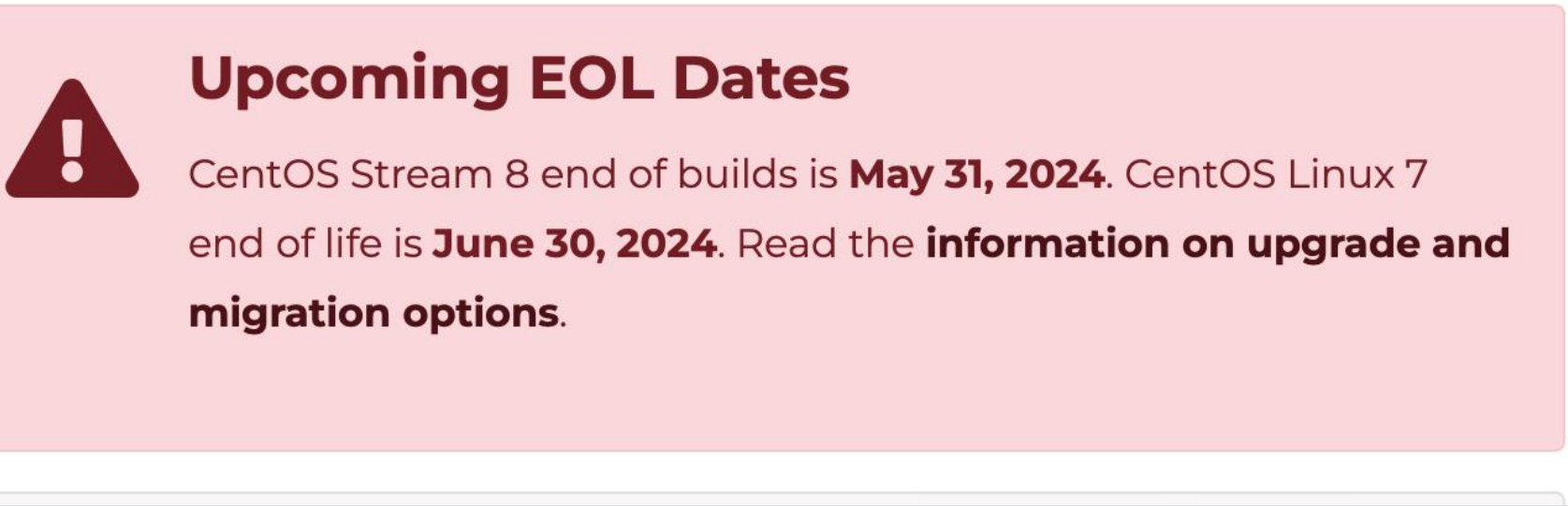
Motivation



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Additional Tasks

- Containerizing some functionality
  - Apache Guacamole server for remote virtual machine access
- Documenting systems in-depth
- Renaming systems
- Hands-on training and onboarding
- Updating software/dependencies
- Updating documentation for system troubleshooting

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Standardized System Questionnaire

Data Flow:

1. Imports:
    a. Does the system have any NFS mounts from local systems or AWS EFS?
    b. Does it have any incoming orb2orb processes in an antelope rtexec?
    c. Does it have any other seismic data imports (esp. Carbon), such as seedlink2orb?
    d. Does it have any PDL data ingestion (e.g. for magnitudes and event locations)?
    e. Does it import any databases, either local or from AWS RDS?
    f. Does it access any SQL databases, in Butrovich or on the AWS RDS?
2. Exports:
    a. Does the system send any automatic emails?
    b. Does it send any automatic text messages?
    c. Does it do any PDL data exports?
    d. Does it export any data via seedlink?
    e. Does it have any outgoing orb2orb connections?
    f. Does it have any NFS mount exports to local systems or AWS EFS?
    g. Does it make any automatic backups (such as database backups, waveform backups, system backups, etc), and what is the process used for them?
    h. Does it host any web services (such as nginx, guacamole, etc), or have any connections to the AWS ALB?
    i. Does it host any SQL databases that are accessed from elsewhere?
    j. Does it do shakemap exports to ComCat?

Data Operations:

1. Does it run any scripts for website operation (such as waveform figures)?
2. Does it run any cron jobs, either in a system crontab or the rtexec?
3. Does it run any continuous processes in an rtexec (other than import and export)?
    a. Is the rtexec persistent (is it run as a daemon on boot by install_boot_scripts)?

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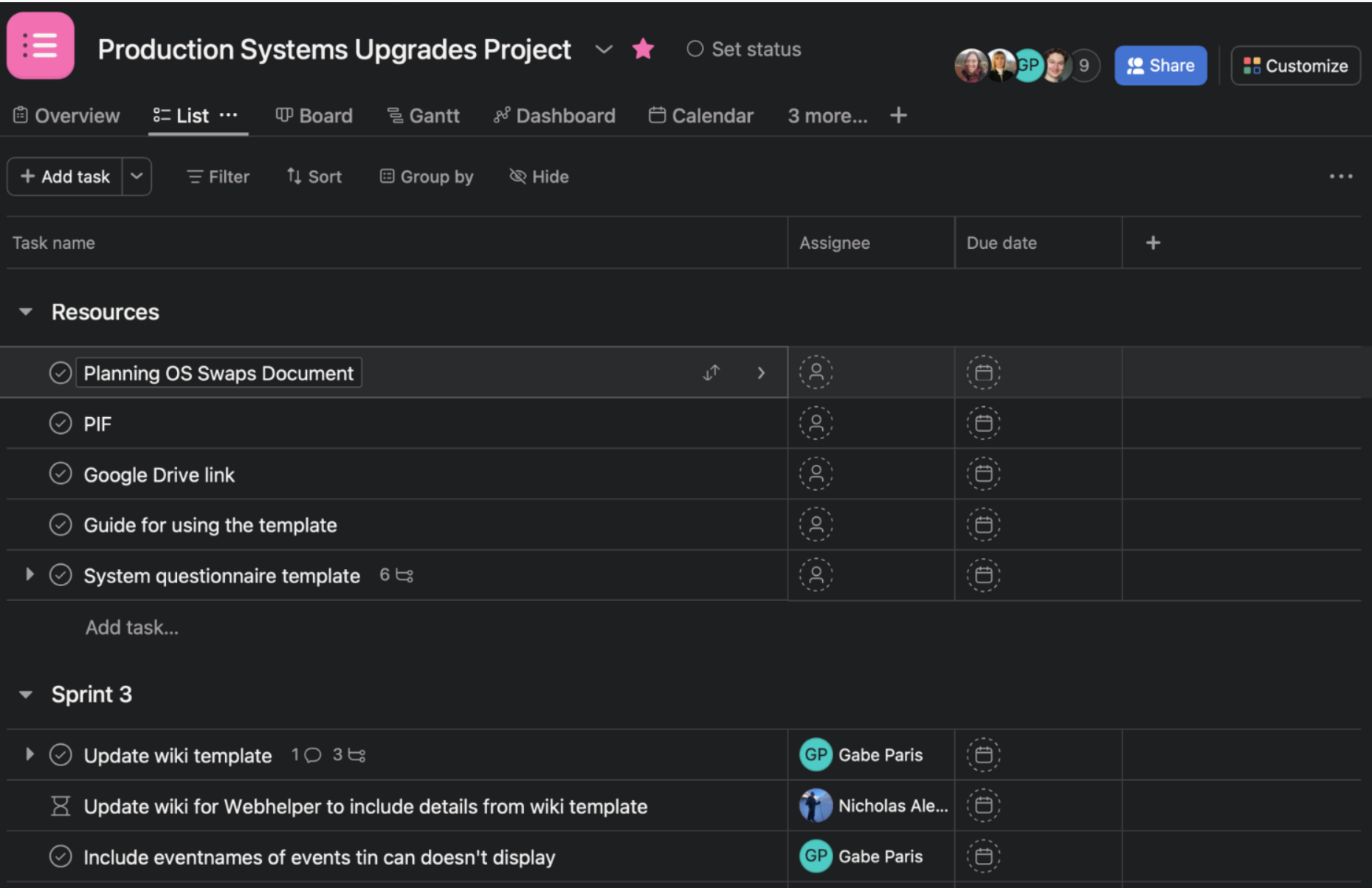
Asana Project



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Where We're at Now

- Early stages
- Moved an 'easy' system over to production
- Created template VM
- Keeping to project scope (lots of opportunities for creep!)
- Open to thoughts/pitfalls/best practices others have come across in similar transitions

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Thank you!

Questions and Thoughts?