



Integrating Micro-Grid Wind into ODIN

using WindNinja, NOAA HRRR, RAWs and Delphire Sentinel data

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What is ODIN-fire?



- Open Data Integration framework for wildland-fire applications
- open source software to build stakeholder-specific, field-deployable servers
- developed at NASA Ames since 2019

- supports

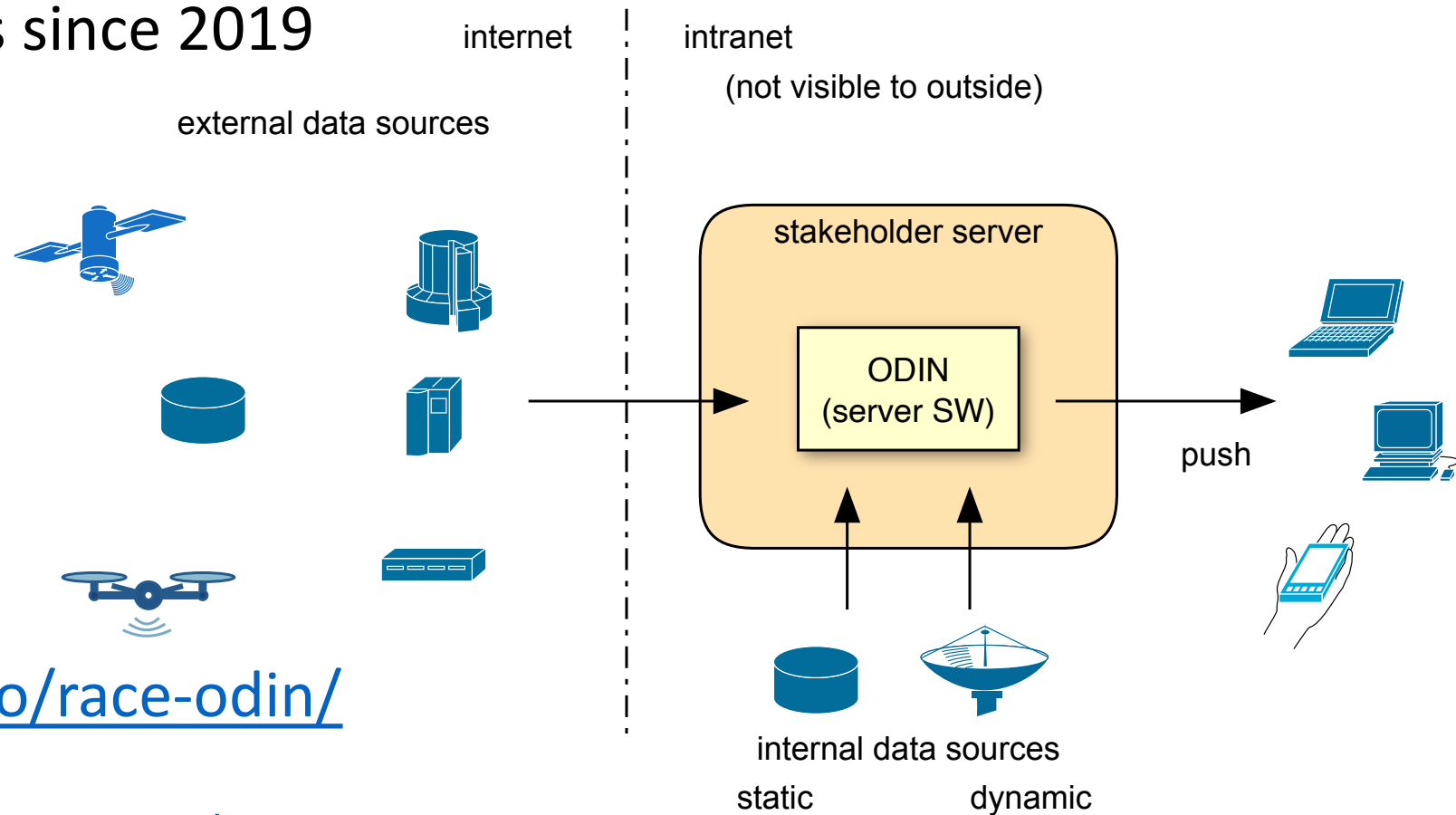
- static data
- dynamic (realtime) data

- **extensible**

- data sources
- functions
- visualizations

- <https://nasarace.github.io/race-odin/>

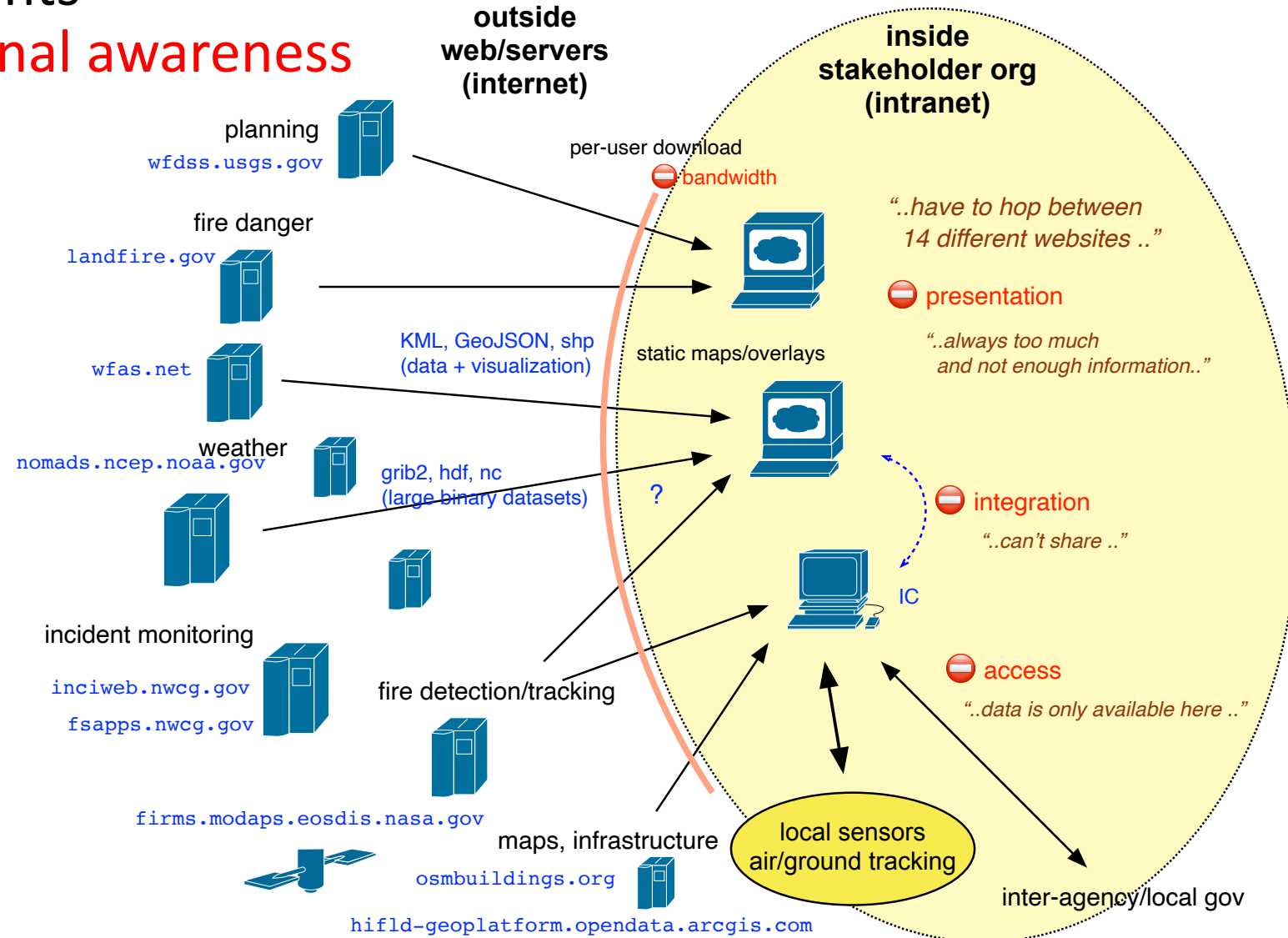
<https://www.youtube.com/watch?v=gCBXOaybDLA>



What Problem is ODIN trying to solve?



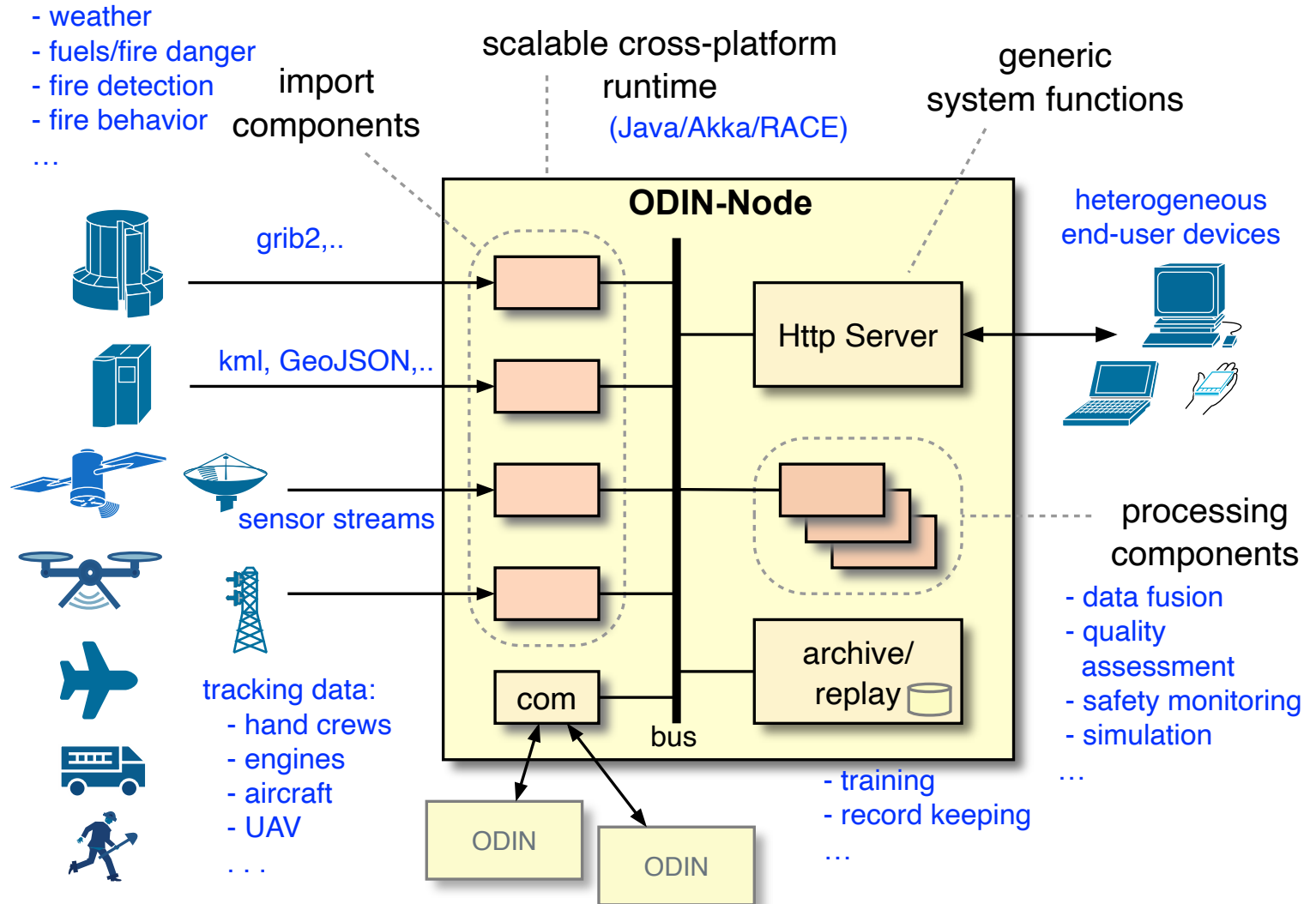
- larger/more complex incidents
⇒ need to **improve situational awareness**
- a lot of data available but..
- external data fragmented
 - different servers/websites
 - data formats/protocols
 - update times/mechanisms
- own (tracking) data *not* on internet
- existing websites cannot be extended
- need for **data integration**



How does ODIN solve data integration?



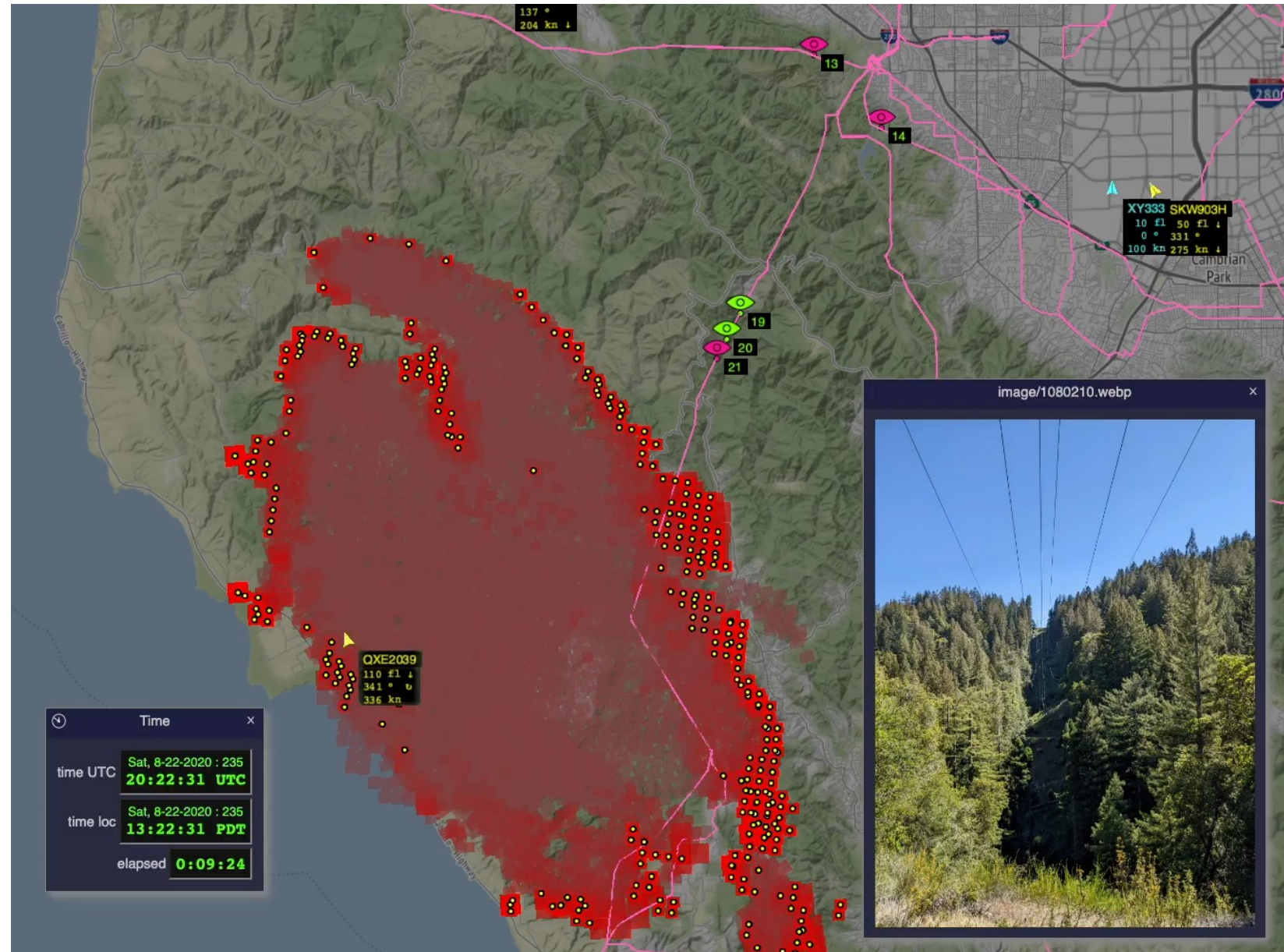
- uniform architecture
 - many application types
 - scalable cross-platform
- **extensible** component lib
 - data import
 - processing
 - generic system functions
- open source library to build *your* projects
- in general: ODIN does not make science - it makes it available



Wind Data Example



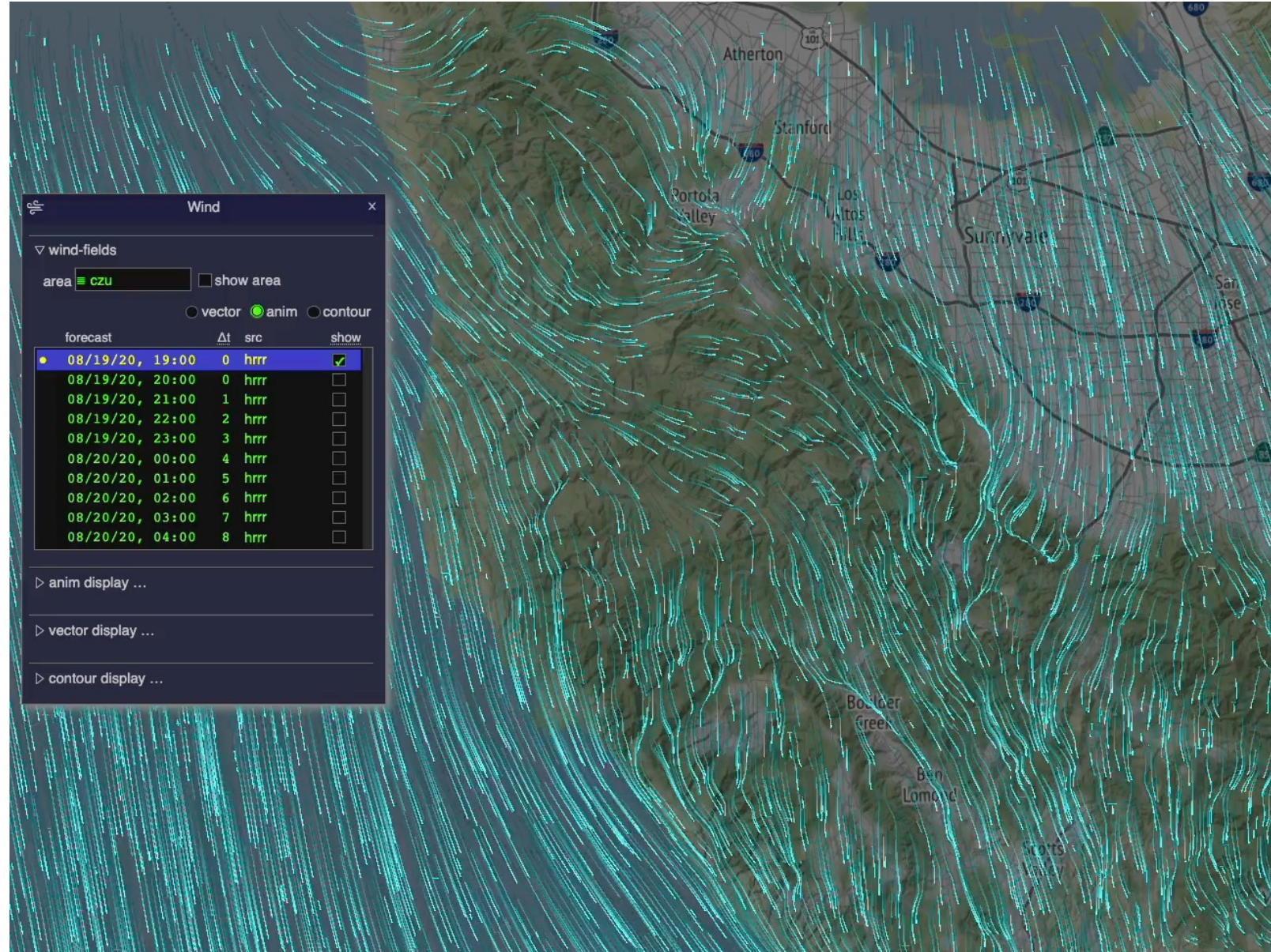
- CZU fire 08/2020 in Santa Cruz mountains
- displaying global wind (public weather sites)
- looks too uniform
- terrain, diurnal winds ?
- areas of high winds ?
- spatial resolution not good enough
- can we do better?
micro-grid wind



The Real Wind – MicroGrid Simulation



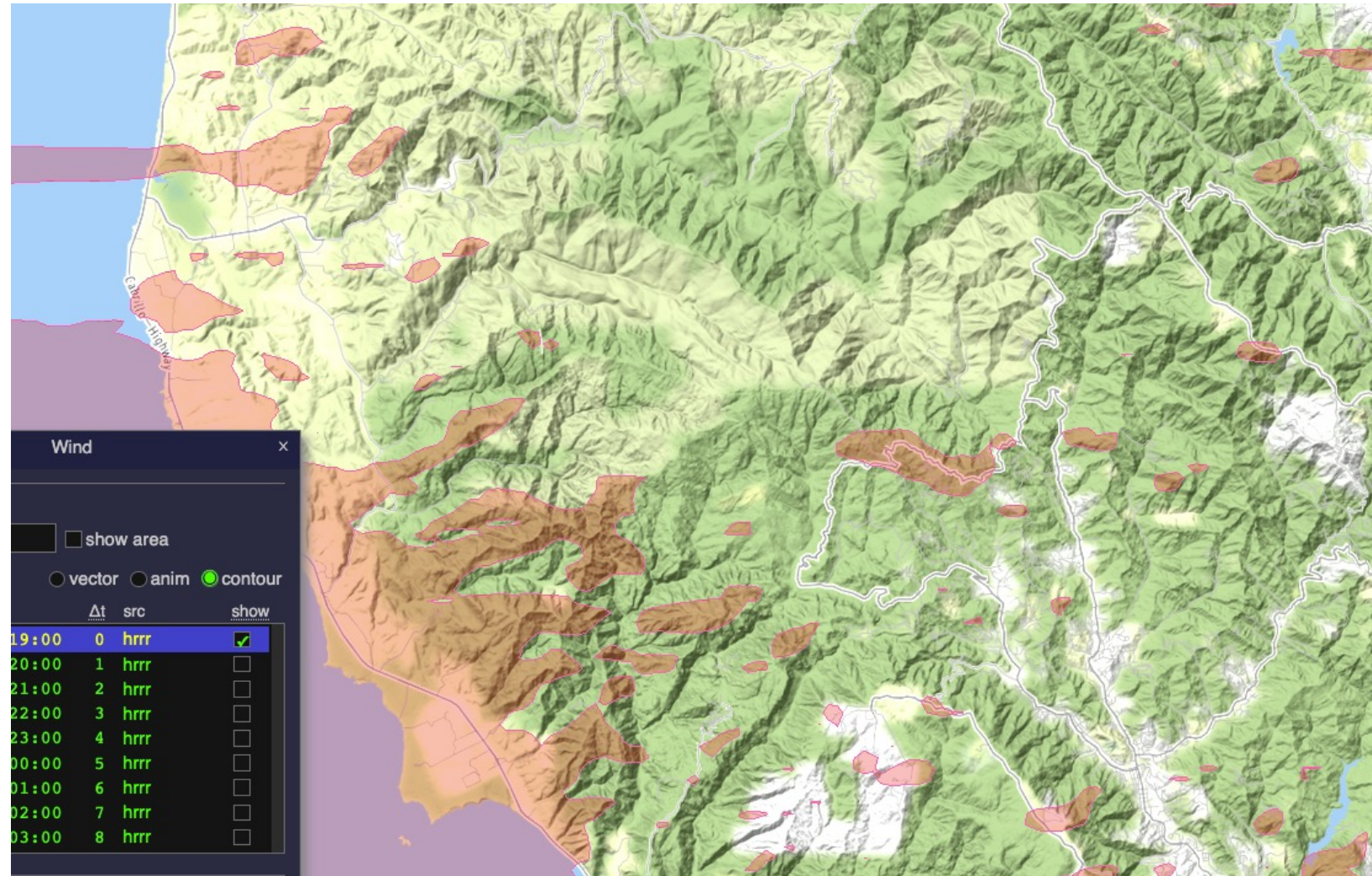
- simulates 250m grid based on HRRR (3km)
- shows huge differences in incident area
- flow follows ridges and creeks
- particle system animation good to capture general flow
- not so good to assess windspeed or higher resolution



More Visualizations – WindSpeed Contour



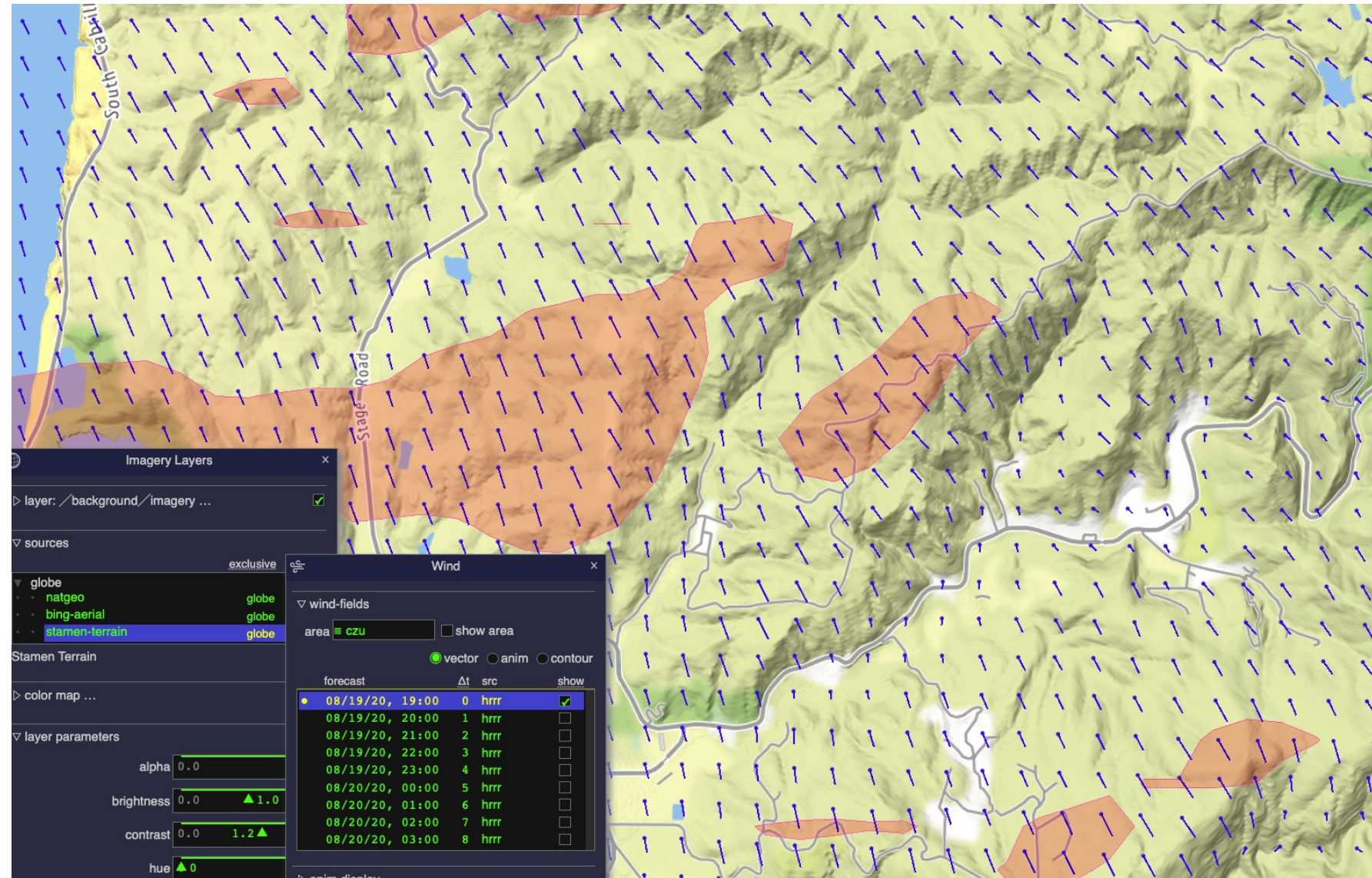
- shows increased speed at windward side of ridges
- good to assess “hotspots”
- could be combined with vector grid at higher resolution



Closer Look – Contour and Vector



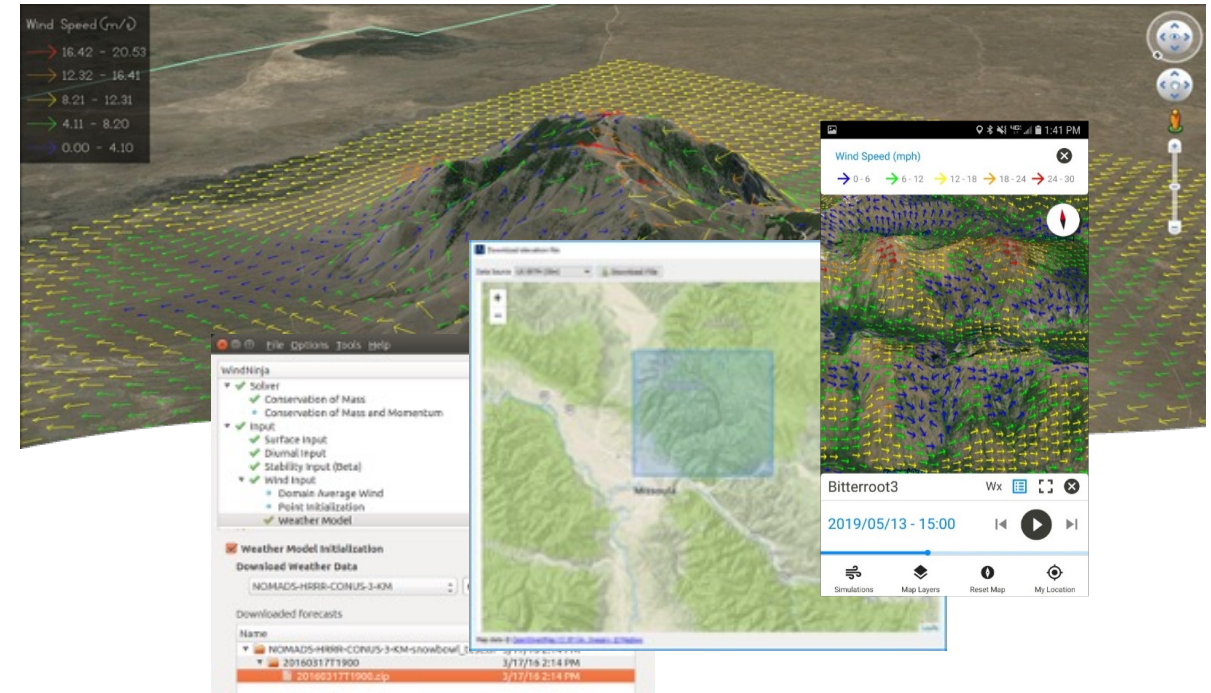
- good for speed and direction at higher resolutions
- needs interactive viewer adaptation
- promising - how did we get here ?
- **WindNinja** does the heavy lifting



WindNinja Wind Simulator



- actively developed at Missoula Fire Sciences Laboratory (RMRS) since 2006
- simulates diurnal/terrain aware wind with high spatial resolution (~100m)
- desktop, command line, library and mobile versions
- can be driven by (forecast) models or weather stations
- 100+ peer reviewed articles well established science
- widely used (IMETs, FBANs, WFDSS, FlamMap,..) 2018: 7+M runs/3+k users
- <https://www.firelab.org/project/windninja>

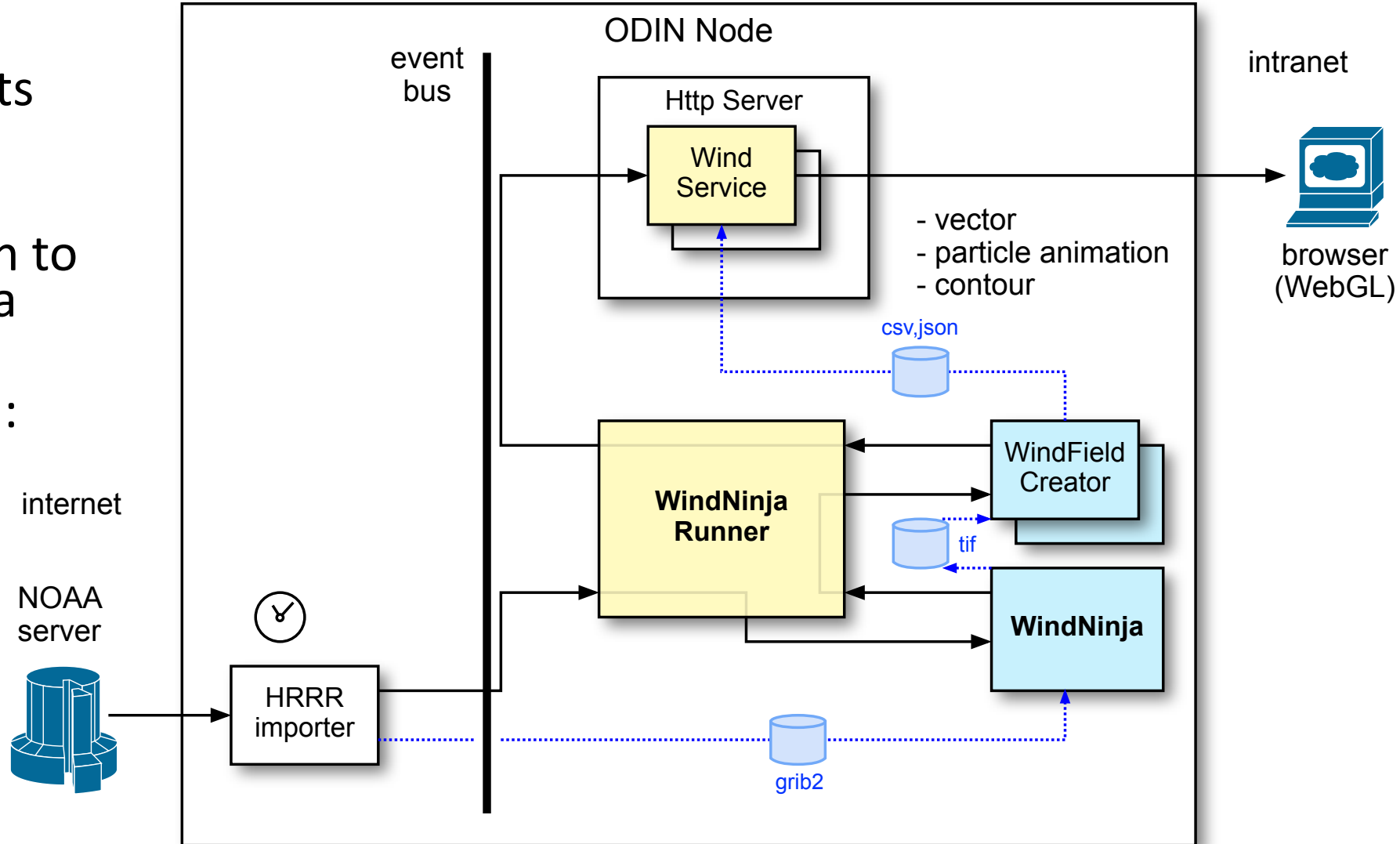


Forest Service
U.S. DEPARTMENT OF AGRICULTURE

Integrate Forecast based WindNinja Simulations



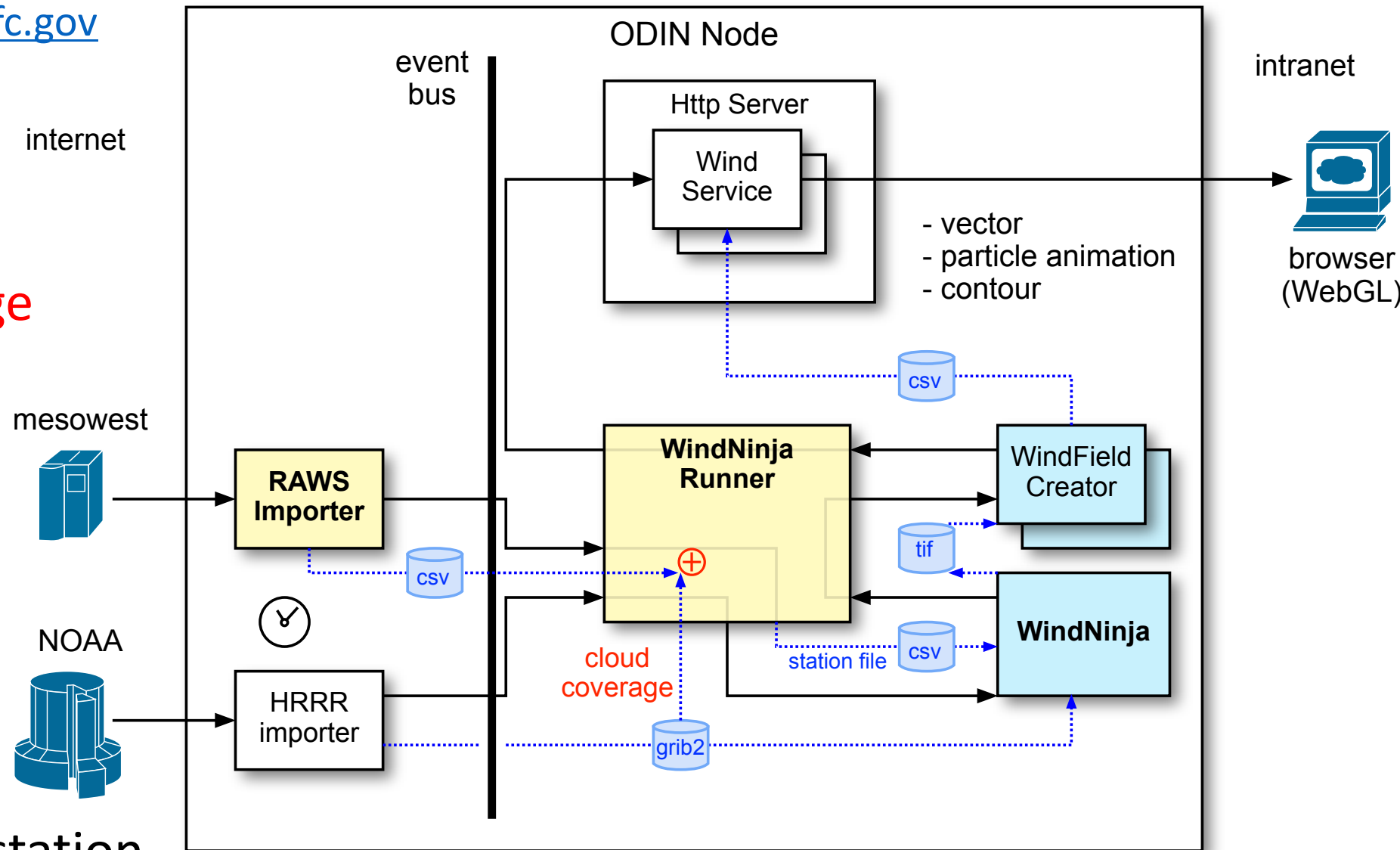
- reuse generic HRRR file importer
- new ODIN components
 - WindNinja Runner
 - http WindService
- new WindNinja option to store generic grid data [h,u,v,w]
- fully automated chain: 400 lines Scala 600 lines JS
- can we do better? use weather station “nowcast”



Integrate Weather Station based WindNinja Sim



- RAWS <https://raws.nifc.gov>
- new ODIN actor:
RAWS Importer
- most stations
miss cloud coverage
- but we can guess:
fill in from
HRRR *TCDC* field
- 200 lines Scala
- can we do better?
integrate “smart” station



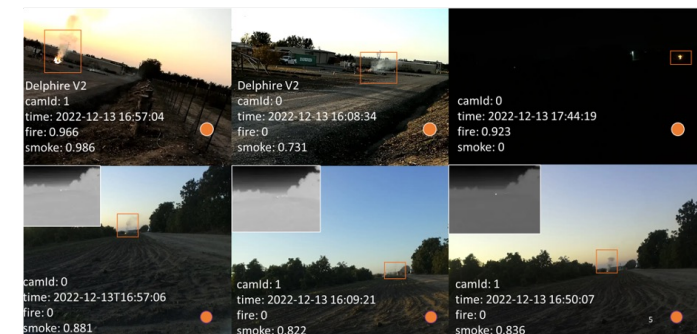
Delphire Sentinels – Extensible Fire Sensor System



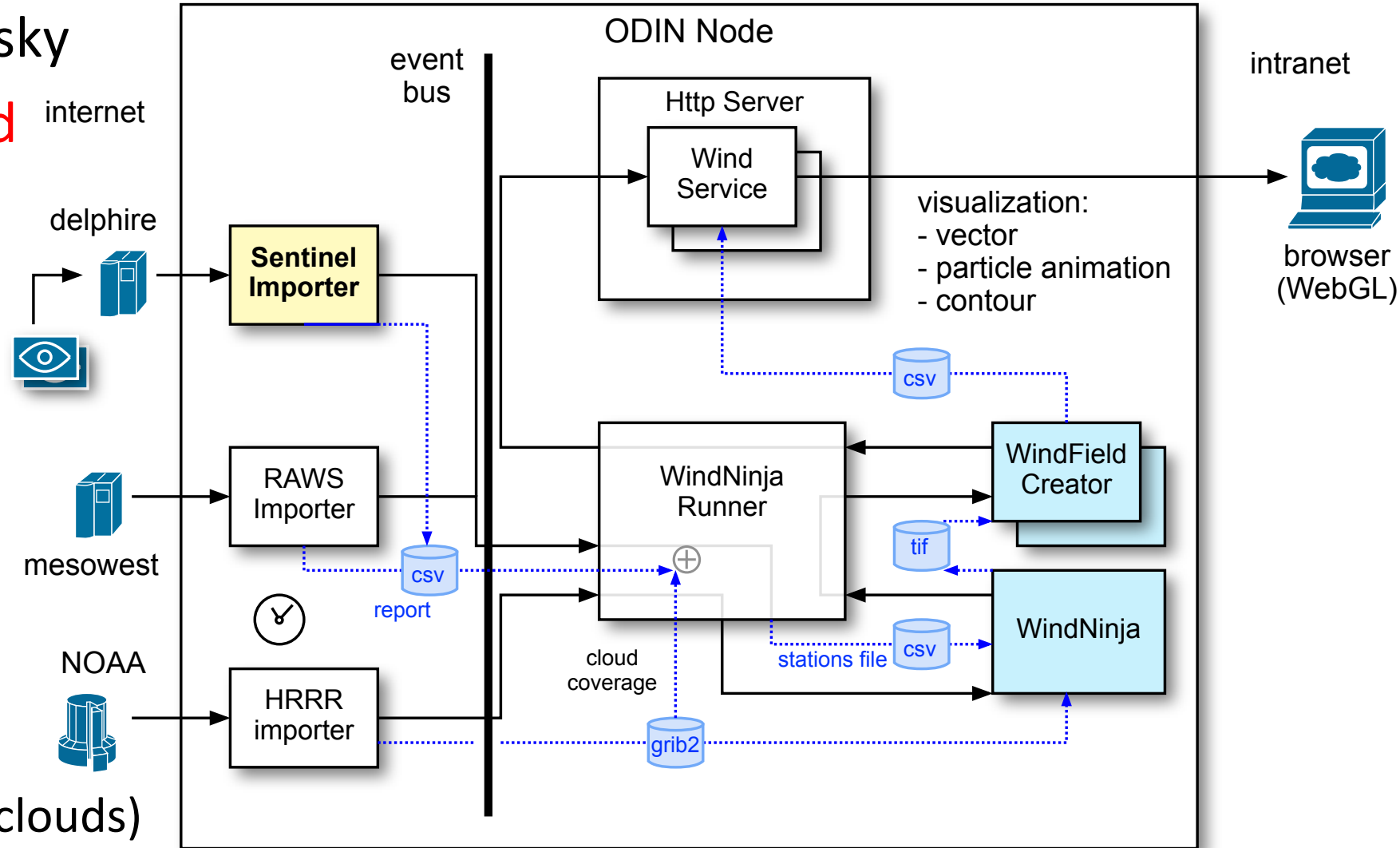
- multi-sensor, multi-network device for below-canopy fire detection from Delphire Inc.
- visual+infrared cameras, gas/smoke, temperature, anemometer, gyro, gps
- **uses on-board AI to classify visual and infrared images in realtime (<60 sec)**
- minimizes bandwidth (satellite + cellular) and power (battery + solar)
- extensible: powerful on-board processor can be used for additional automation (dip-tanks etc.)
- <https://delphiretech.com/>



THE SENTINEL FD3.



- internet



ODIN - Vision



- create free and extensible ecosystem for
 - fire agencies
 - research orgs
 - vendors
 - local communities
 - ... and more
- enable sharing
 - data
 - visualizations
 - algorithms

