

7A.5 National Weather Service RIDGE 2 Radar Data Architecture and Warning Geographic Information System Services

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1. INTRODUCTION

The display of radar data on the World Wide Web is a critical piece of the mission of the National Weather Service (NWS). The display of radar typically accounts for nearly forty percent of the daily web traffic and can peak as high as eighty percent during major storms. RIDGE (Radar Integrated Display with Geospatial Elements) was an important step in the evolution of the display of radar on NWS web pages. RIDGE introduced a layered approach using georeferenced graphics interchange format (GIF) images for radar, boundary and topographical data. RIDGE2 improves upon the original RIDGE design by displaying the data in a web mashup using a web mapping application programming interface

(API). This paper will discuss the changes involved with the RIDGE2 architecture.

2. RIDGE2 ARCHITECTURE

RIDGE2 uses an open source GeoStack consisting of Postgresql/PostGIS, Mapserver, Tilecache and OpenLayers. RIDGE2 offers data and services to the NWS' core customers in Open GeoSpatial Consortium (OGC) complaint formats.

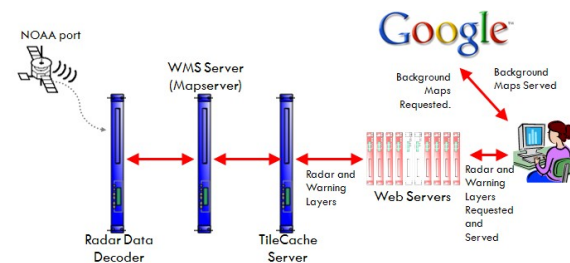


Figure 1: RIDGE2 data flow

2.1 Decoders

RIDGE2 uses Java based decoders for the ingest of NWS text product and radar data. The

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Weather Service."

data decoders are platform independent and utilize the Spring and Hibernate frameworks. The decoders are multithreaded and loosely coupled, making them easily extendible. NWS text products are decoded and stored in the PostGIS database. Currently all NWS Valid Time Event Code (VTEC) encoded products are stored in the database. Binary radar data is decoded and converted into transparent Portable Network Graphics (PNG) image format with 1000 x 1000 pixel resolution and projected into the World Geodetic System 1984 coordinate system. Currently ten radar products are decoded for NWS WSR-88D radars (including base reflectivity, base velocity, storm relative velocity, vertically integrated water, one hour precipitation and echo tops). Radar data is also decoded for 45 Federal Aviation Administration (FAA) terminal doppler weather radars (TDWR) and six airport surveillance radars (ASR).

2.2 PostGIS Database

RIDGE2 uses a Postgresql database with the PostGIS (<http://postgis.refrations.net/>) extension for the storage of meteorological data and radar metadata. The PostGIS extension allows for the native storage of geometries in the database. These geometry objects can then be displayed by various GIS (Geographic Information System) server and client applications, allowing the database to act as a backend GeoSpatial database for GIS servers. Weather hazard data is stored in using the highly relational Iris schema which stores the NWS hazard information at a fairly atomic level. The PostGIS extensions also allow for various GIS queries to be made against the data, including unions, area calculations, and features within.

2.2 MapServer

RIDGE2 uses MapServer (<http://mapserver.org/>) for web mapping services (WMS) and to create low bandwidth static images. For the display of NWS hazard data, the polygon geometries are rendered directly from the PostGIS database with the traditional NWS watch/warning/advisory map color style applied to the data. The radar data is rendered directly from the 1000 by 1000 pixel PNG images. The advantage of using the WMS service over displaying PNG images is that the image is rendered on the fly as a user zooms,

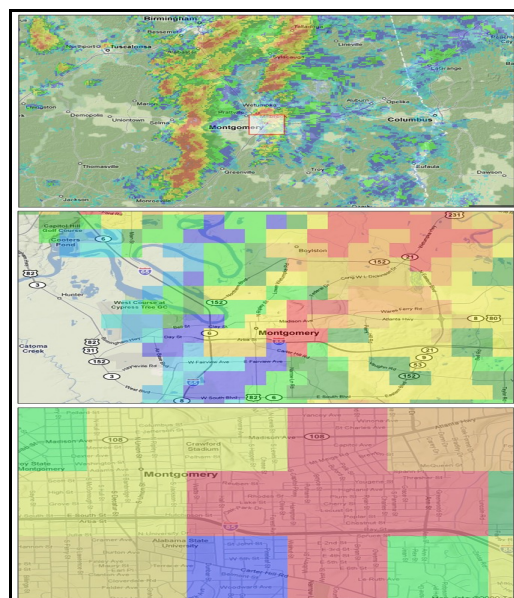
therefore displaying the highest quality image possible. RIDGE2 utilizes a time based web mapping service (WMS-T) for the display of radar data. This format allows the user to request any valid radar time in the database.

2.3 TileCache

RIDGE2 uses TileCache (<http://tilecache.org/>) for map tile map services. TileCache decreases the load on a WMS server by caching the results of WMS requests as a set of map tiles. The tiles are 256 x 256 pixel images which represent sectors for each zoom level of the map. When a request for a map tile comes into TileCache, the application first checks its map cache to see if it already has the tile. If not, then TileCache requests it from the WMS server. Most users accessing the RIDGE2 web page will receive data directly from TileCache rather from the WMS service which will provides faster data access times. The tile cache is purged based on data expiration requirements, warning polygons are cached for two minutes, radar data for about three hours, and geographical boundary data is cached perminately.

2.4 OpenLayers

RIDGE2 uses OpenLayers (<http://openlayers.org/>) as its web mapping API. OpenLayers is an open source JavaScript library for displaying map data in web browsers and provides an API for building web-based



geographic applications similar to Google™ Maps and Bing™ Maps.

Figure 2: The various zoom levels of RIDGE2

The RIDGE2 web page is a mashup of GIS data layers (radar and NWS hazard data) displayed on top of Google™ base maps. This mashup decreases the bandwidth requirement for the NWS web servers as the base map data is served from Google™ and not from the NWS web servers. OpenLayers was selected as the web mapping API because of its flexibility. OpenLayers separates the API from the underlying base layer data. This allows the programmer to select base layer data from a number of sources (Google™, Bing™, or OpenStreetMap) without having to convert the application another mapping API. OpenLayers also supports a wide arrangement of Open Geospatial Consortium (OGC) formats.

3. DATA DISPLAY CHANGES

RIDGE2 implemented several major changes to the web interface from the RIDGE interface. First, all NWS hazard data is now displayed on the page, versus just the tornado, severe thunderstorm, flash flood and special marine warning polygons on RIDGE.

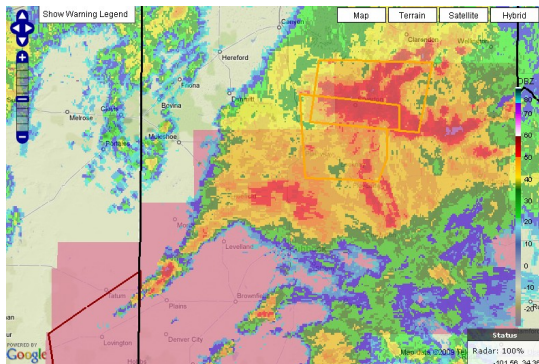


Figure 3: The RIDGE2 display showing the integration of radar and NWS hazard data.

Second, the primary radar display layer is now a national mosaic. By using the national mosaic, redundant radar coverage for many areas will help to fill in any “gaps” of coverage that may occur when any radar is down for maintenance. The user is no longer greeted with “No Radar Data are Available for this Area...” message when viewing the RIDGE2 page.

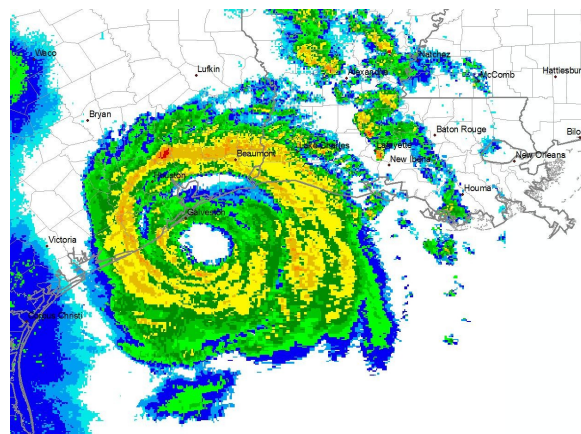


Figure 4: Sample Mosaic (Without HGX Radar Available) – Hurricane IKE

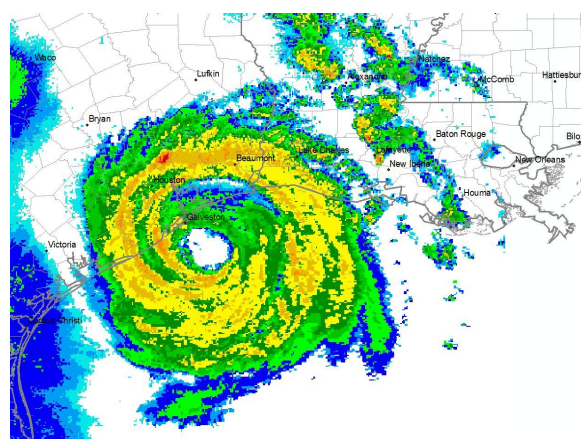


Figure 5: Sample Mosaic (With HGX Radar Available) – Hurricane IKE

4. SUMMARY

The display of radar data is an important part of the NWS mission. RIDGE2 enhances the display of radar data by creating an interactive web mashup of GIS layers of NWS hazard and radar data. RIDGE 2 is currently considered experimental, and it is planned for official rollout in March 2010. RIDGE 2 will replace the existing RIDGE web pages at that time.

5. REFERENCES

Stellman, Keith, P. Kirkwood, J. Burks, S. Rae, I. Graffman, 2007 : RIDGE - Radar Integrated Display with Geospatial Elements - Planned Updates and Enhancements to the NWS New Radar Webpage . AMS Conference Preprint. 4B.6