Final Technical Report

"Linux Server in the Cloud"

UCAR/Unidata Equipment Grant

This project created a dedicated cloud-based Linux server in support of Embry-Riddle Aeronautical University's (ERAU's) Emergency Response Meteorology (ERM) certificate program (Woodall et al., 2015). It enabled ERAU meteorology students to develop skill and experience analyzing gridded forecast model data and other weather observations in real time from any location where mobile Internet service was available. Unidata graciously provided the funding and technical assistance needed to build the Linux server in Amazon Web Services and install the AWIPS II EDEX server and CAVE client. The details of the Linux server configuration are described by James and Weber (2016a, 2016b, 2016c) and James et al. (2015). This was the first instance of AWIPS II hosted by a university in the cloud, thanks to Unidata's help. The cost of the server varied by usage and infrastructure allocations (memory, processing, data downloads, etc.) from about $200 - $800 per month. There were no data upload costs, since Unidata provided a live data feed within the cloud.

ERAU students and faculty were then trained on the CAVE client by the NWS and through detailed written access instructions. The instructions included installation of a Linux emulator software for their own machines to access the ERAU cloud server from any location. Students were able utilize AWIPS II in their upper-division meteorology courses, including a Forecasting Techniques course. Several lab assignments each semester were dedicated to familiarizing students with AWIPS II navigation and capabilities. All of the upper-division students at ERAU in the past two years (2015-16 and 2016-17) have thus gained a working knowledge of how to create a variety of meteorological maps and displays in AWIPS II. Fig. 1 depicts a student using AWIPS II to draw an isobaric chart, then specify a user-defined vertical cross section of gridded model output.

Some of the challenges during the project included firewall settings, data outages, and network latency issues. The firewall on the cloud server was initially restricted to only Linux IP addresses internal to the ERAU campus. This setting required students and faculty to relay all AWIPS II commands via an intermediate Linux server on campus. This extra step was inconvenient to those needing to access the software regularly, and it increased latency. The problem was remedied by opening the firewall on the cloud server completely, despite the added security risk. There were also regular EDEX Server data outages, most of which needed to be remedied by Unidata technical staff. The biggest challenge, however, has been network latency. To reduce latency, two fast Linux machines were purchased for the ERAU Meteorology Lab to eliminate the need to relay commands through an intermediary Linux server. Moreover, with the release of a new Windows version of the CAVE client, we were able to install CAVE on all Windows computers in the lab and all student and faculty laptops running Windows. These changes have improved latency, but there are still delays experienced between the time a user requests a specific graphic and the time he/she receives the rendered product in the CAVE client. This time delay continues to be our biggest challenge.

All-in-all this project has been very educational and has given our faculty and students necessary access to operational meteorological analysis and display software. Several conference presentations and a book chapter have resulted from this project (see references below). Although this Unidata grant

has now expired, ERAU continues to enjoy access to AWIPS II through a cloud-based server hosted by Unidata on an ongoing basis (free of cost to the university). This same opportunity is available to all meteorology institutions for education and research applications needing remote access to AWIPS II visualization capability.

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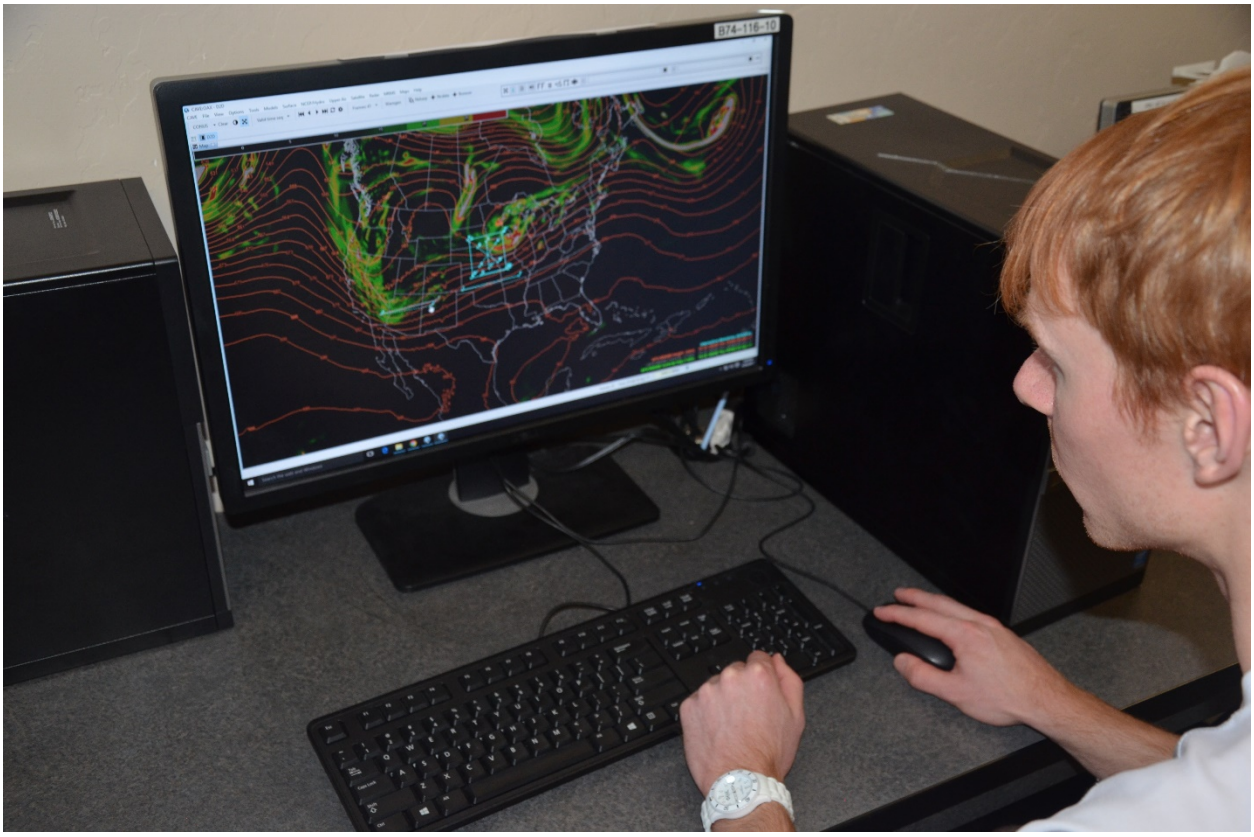

Figure 1. Undergraduate meteorology major using AWIPS II to create a vertical transect of forecast model output.

References

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