

THE NATIONAL WEATHER SERVICE SHARES DIGITAL FORECASTS USING WEB SERVICES

BY JOHN L. SCHATTEL JR. AND ROBERT BUNGE

In 2006, the NOAA National Weather Service (NWS) declared its first-ever Simple Object Access Protocol (SOAP) Web service (<http://weather.gov/forecasts/xml>) operational. Now, Web-application developers can use Internet standards such as Extensible Markup Language (XML) and SOAP to access the NWS official 7-day digital forecast found in the National Digital Forecast Database (NDFD). By using World Wide Web Consortium (W3C) data-exchange standards like XML and SOAP to disseminate these sensible weather forecasts, the NWS is embracing a future where its products and services are available in more convenient and understandable forms. Helping to realize that future, the NWS NDFD SOAP service is making it easier and less costly for Web developers to integrate digital forecast data into a Web application.

The NWS's use of XML benefits Web developers by encoding the data in a machine-readable and portable format that uses text characters. By relying on plain text, XML frees Web developers from concerns about which operating system encoded the data. In addition, XML obeys a predictable set of rules, which makes the data easy to read. Tools that understand these rules and can separate the data from the XML are built into many popular computer programming languages.

Complementing XML's portability and readability, SOAP provides the Web developer with the means to request and receive the XML-encoded data. Figure 1 depicts a SOAP request, originating from the user's SOAP client, being sent to the NDFD SOAP service

server. The server responds with the requested NDFD data wrapped in XML and transported to the user's client in a SOAP message. Since SOAP is supported in many programming environments, Web developers will find it a convenient, familiar, and labor-saving choice for their data-transport protocol.

While Web developers are the primary users of NDFD SOAP service data, end users range from the general public to companies specializing in information packaging or focused services to other government agencies requiring weather data and information. These many and varied end users of NDFD data create high demand for the Web service. In the month preceding the service becoming official, this demand translated into 109 million requests for data. This volume of usage made the Web service the most visited address on the NWS Web site.

The use of XML and SOAP does have its challenges. For example, the NWS needed to create a new dialect of XML to ensure the best fit between XML tag names and structure and the data found in the NDFD. However, this design decision added another entry to the list of XML dialects used by meteorological organizations around the world. The proliferation of meteorological XML dialects with their lack of standardization is facilitated by the fact that none has emerged as a clear XML standard. As a result, using the new NWS dialect called Digital Weather Markup Language (DWML) has forced Web developers to learn another XML dialect and write software to process it. Fortunately, the effort to learn and process DWML is lessened by the language's schema, which is a machine-readable description of DWML's list of tags (vocabulary) and tag order (grammar). By reading the schema, a decoding program knows what data structures to expect and automatically does much of the decoding setup work for the software developer. Section 3 of this article's digital supplement (DS, http://weather.gov/BAMS_DS) shows the DWML schema.

SOAP has its issues, too. As a machine-to-machine transport protocol, it is easy for Web developers to use SOAP to automate repeated requests

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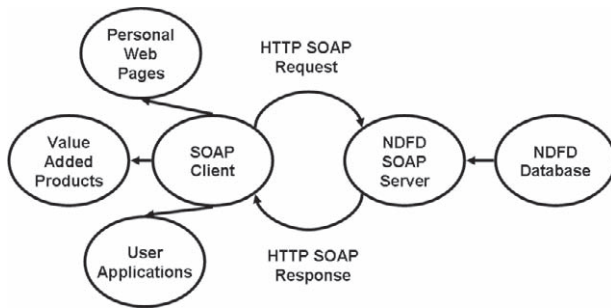


FIG. 1. NDFD SOAP service data flow.

for data. Web developers who are unaware that the contents of the NDFD change hourly could automate needless requests every second, severely straining the Web server. To mitigate the impact of user excess, refresh intervals in the DWML could be provided, recommendations for using the SOAP service could be placed online, responses could be cached, and an application for creating DWML-encoded data could run on a user's computer (see DS Section 10).

The NDFD SOAP service allows Web developers to access four single gridpoint-based products. They are named time-series, glance, 12 hourly, and 24 hourly. The time-series product is composed of one or more user-requested NDFD weather elements, each having data valid at a single location over multiple times. A time-series product can contain any combination of NDFD elements. The strength of the time-series product is that it allows a user to retrieve only the NDFD elements and times they need. On the other hand, the glance product always contains time series of maximum and minimum temperature, cloud cover, weather, and links to an icon representing the weather. The NWS created this prepackaged collection of elements to supply the same information found in the "Forecast at a Glance" section of an NWS point forecast Web page and to provide a DWML version of a bare-bones weather forecast.

The 12- and 24-hourly products take convenience a step further by summarizing NDFD weather data over 12- or 24-h time periods, respectively. For example, if a weather forecast for a 12-h period includes fog, drizzle, and rain showers at different hours, the 12-hourly product's weather element would be summarized to contain the most significant weather type—rain showers. In addition to summarized weather, each period of the 12- and 24-hourly products contains a two-word phrase

corresponding to the summarized weather, a link to a weather conditions icon, one (12-hourly product) or two (24-hourly product) 12-h probability of precipitation value(s), and maximum and minimum temperatures. The NWS developed these products to mirror the weather elements contained in its legacy text Zone Forecast Product and to supply data that might be frequently requested for display on personal Web pages. You can view examples of all four products (DS Section 4) and the Forecast at a Glance and Zone Forecast Products (DS Section 7) in the digital supplement.

By sharing DWML-encoded NDFD data using a SOAP service, NOAA's NWS is embracing W3C data encoding standards to more fully leverage the value of the Internet to reach its customers. Using the Internet and encoding standards familiar to Web developers lowers the cost of entry into the marketplace and makes it easier for individuals and businesses to acquire and use NDFD data. Such efficiencies represent another step toward a future where digital services play a key role in meeting society's increasing need for weather information.

FOR FURTHER READING

- Glahn, H. R., and D. P. Ruth, 2003: The new digital forecast database at the National Weather Service. *Bull. Amer. Meteor. Soc.*, **84**, 195–201.
- NWS, 2005: Working together to save lives. National Weather Service Strategic Plan for 2005–2010, 36 pp. [Available online at http://weather.gov/sp/NWS_strategic_plan_01-03-05.pdf.]

ECHOES

“ Kingdom Finds Itself in Icebox ”

—Front-page headline in a recent edition of Saudi Arabia's *ARAB NEWS* after a January cold spell sent temperatures plunging throughout the Middle East. The mercury dipped to -6°C in Saudi Arabia, -16°C in Syria, and -24°C in Iran, and at least 300 deaths in the region were blamed on the cold and snow. But rare snowfall in Baghdad, Jerusalem, and elsewhere brought joy to many who were unaccustomed to such conditions. "The snow brings people together," explained Jerusalem resident Oded Goldberger. "It's something really special."

(SOURCES: BBC News; news.scotsman.com)