Development of a Real-time Tsunami Forecasting System

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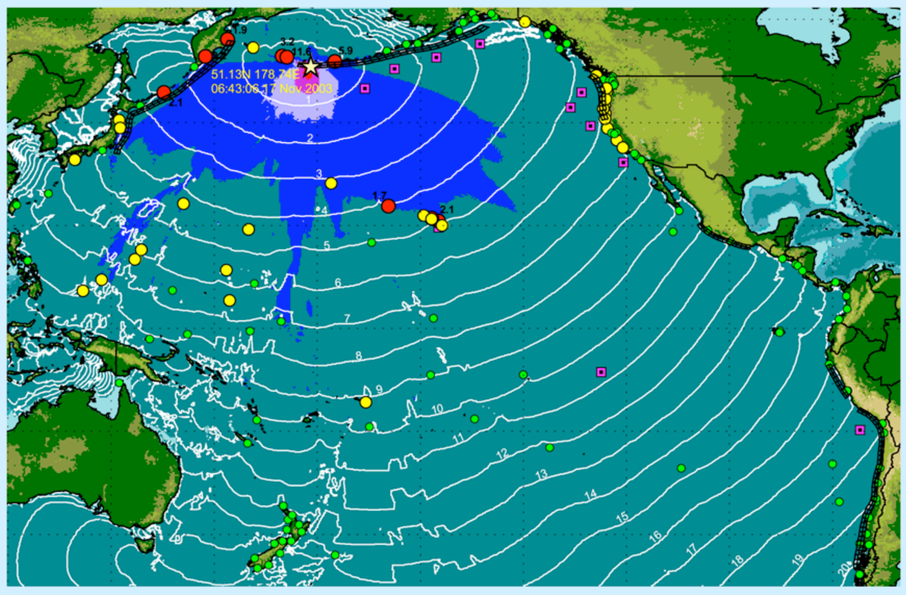
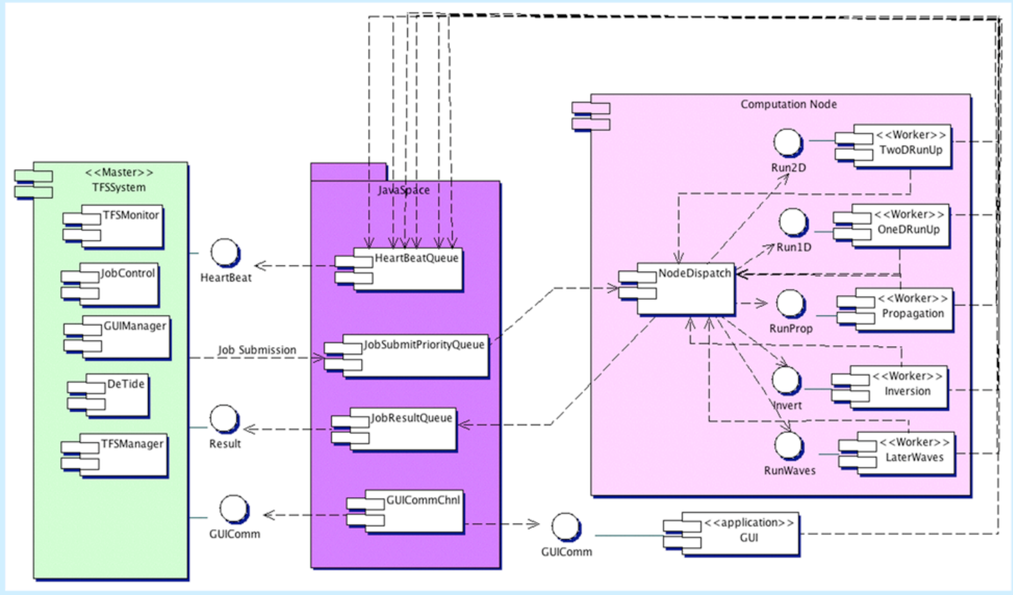
The NOAA Pacific Marine Environmental Laboratory National Center for Tsunami Research is developing a tsunami forecasting system known as SIFT (Short-term Inundation Forecasting for Tsunamis) for use in NOAA Tsunami Warning Centers. This system combines state of the art modeling and measuring technology to provide real-time tsunami forecasts. System design employs Java/Jini technology to combine data assimilation and inversion schemes with Fortran-based numerical models. Forecast products include estimates of tsunami amplitudes, flow velocities, and arrival times for offshore, coastal, and inundation areas. These forecast tools provide Tsunami Warning Centers with practical methods to assess the tsunami hazard and deliver rapid and accurate warning guidance to at-risk communities.

Tsunami Forecasting System Objective



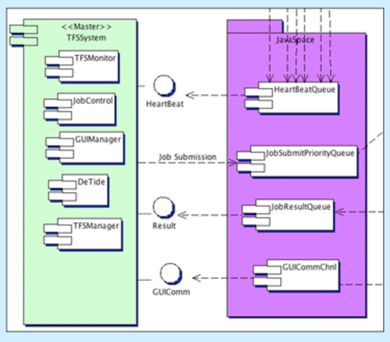
The primary goal of the system is to provide NOAA Tsunami Warning Centers with operational tools that combine real-time seismic and sea level data with numerical models to produce efficient tsunami forecasts of wave arrival times, heights, and inundation.

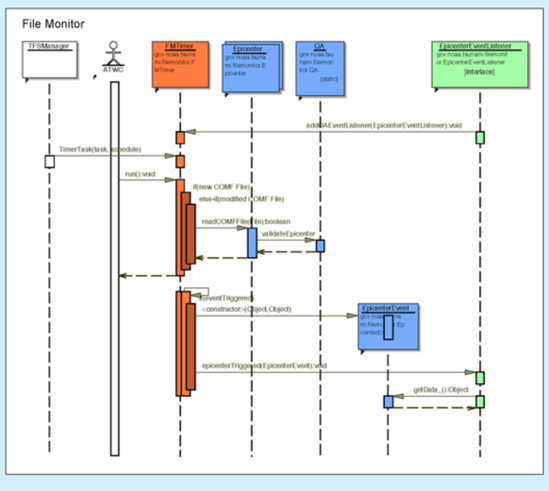
System Design

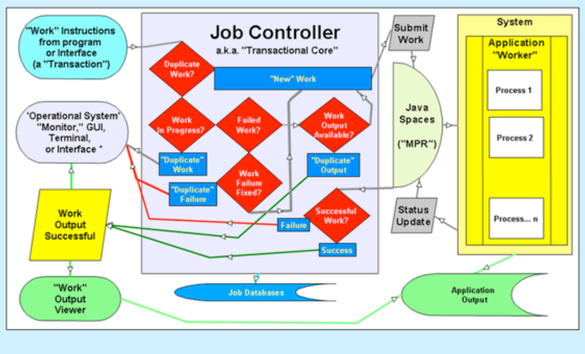


The system has a modular design with a robust cross-platform architecture. The primary programming language is Java (J2SE5.0) with Jini 2.1 technology for network services. The models are written in Fortran 77. Development is performed in JBuilder using Java coding standards with JUnit testing. Subversion 1.2 is used for configuration management.

Core Components

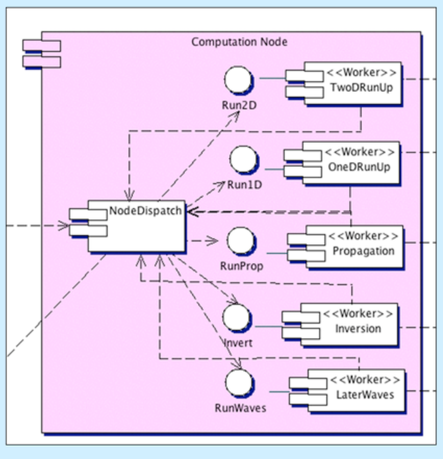






The core components control transactions and perform data/system monitoring. JavaSpaces are used to communicate between different components. A PostgreSQL relational database is used to manage jobs, data, and configuration parameters.

Computational Components

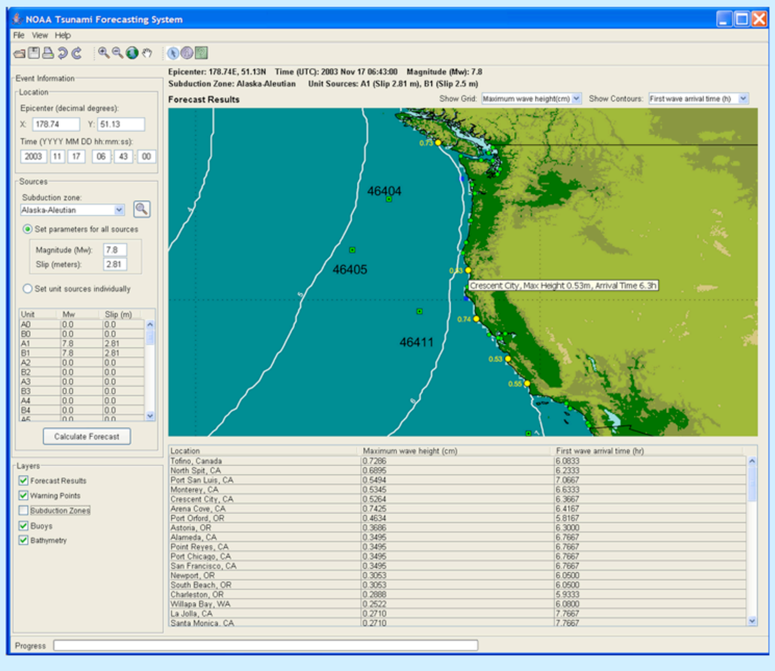


The first version of the system will include the propagation node, which uses pre-computed model runs of unit tsunamigenic sources. The data are stored in netCDF files, with metadata stored in a PostgreSQL database.

The propagation node outputs an offshore forecast of wave heights and arrival times. Coastal forecasts for selected warning points are developed based on a multiple of the nearest offshore grid cell.

Computational nodes represent the actual numerical models that develop the forecast output. The nodes are run through a dispatcher control.

Graphical User Interface



The GUI is designed for easy access to model results with minimal user input. Offshore and coastal forecasts can be generated automatically or based on user input. The design will be modified based on usability requirements and tests from both Tsunami Warning Centers.

Next Steps

The GUI design and implementation schedule will be finalized during visits with each Tsunami Warning Center.

The first version of the forecasting system will be implemented at the Tsunami Warning Centers in March 2006. This version will include most of the core components and the ability to obtain offshore and coastal forecasts based on real-time seismic data.

The second version will include inversion with real-time sea level data from deep-ocean buoys (also known as tsunameters or DART buoys) to improve the coastal and offshore forecasts. Future versions will include inundation and later waves forecasts.

More Information

For more information, please contact Angie.J.Venturato@noaa.gov

Tsunami Warning Guidance http://tsunami.gov/

NOAA/PMEL National Center for Tsunami Research http://nctr.pmel.noaa.gov/

University of Washington http://www.washington.edu/

Joint Institute for the Study of the Atmosphere and Ocean http://tao.atmos.washington.edu/