Generating ITU-R P.452 Radio Propagation Contours on S.O.S.

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Problem

NASA has developed a software solution that implements the ITU-R P.452-15 recommendation. This recommendation is used to calculate the interference between ground transmitters and receivers. NASA’s implementation of this algorithm requires about 36 days to execute. NASA requires a reduction in the run-time of this implementation.

NASA’s research into remote sensing has many implications for the wireless communications industry. To illustrate the importance of this research to the public, NASA would like to develop a dataset to display on the Science on a Sphere projection system.

Objectives

To address the problems stated above, we have:

- Transcribed NASA’s existing implementation of the ITU-R P.452-15 algorithm from MATLAB to the C++ programming language.
- Implemented parallel processing techniques to reduce execution time.
- Developed a 4 minute video that illustrates NASA’s continuing remote sensing research and its importance to the wireless communications industry on the Science on a Sphere projection system.
- Develop interference contours to help viewers understand the effects that atmospheric conditions and the geographical location can have on path losses.

Software Development

The software development portion of this project was broken into 4 main development phases:

1. Planning, research, and setup of development environment.
2. Transcription of existing 40 NASA MATLAB functions to C++.
3. Verification of the consistency between the MATLAB and C++ versions of the code.
4. Addition of multithreading techniques and code refactoring.

Average Speedup: ~777.666

SOS Dataset Development

The video script was developed to cover the following four major topics:

2. Remote sensing research and its applications.
3. Factors that affect ground communications.
4. Demonstration of path losses.

SOS Dataset Results

Comparison of Runtimes

Path loss for extended components vs transmission distance

Path loss for extended components vs transmission distance

Path loss for extended components vs transmission distance

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