

Scaling Public Health Response Capabilities to Address the Demands of the COVID-19 Pandemic

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Introduction

The COVID-19 pandemic highlighted deficiencies in our Nation's ability to respond to widespread public health emergencies.

Next Generation Sequencing (NGS) of COVID-19 clinical isolates is essential for variant surveillance, but the US was behind more than 30 other countries in submission of genomic sequences to public repositories.

Sequencing capacity must be supported by appropriate computational, storage, analysis, and visualization resources

We present our efforts to support our Nation's response to the COVID-19 pandemic and CDC's scaling NGS based surveillance to the level required to keep pace with emerging SARS-CoV-2 variants.

Methods

Collaboration

Web Portal [ReactJS, JavaScript]
Large Scale Data Transfer [Agave/Tapis]
Resource-Based Access Control [Java]

Computing

High-Perf. Computing [UGE, SLURM]
Elastic Cloud Computing [AWS]
Workflow Engines [Nextflow, Snakemake]
Bioinformatics Pipelines

Data Visualization

Public Health Dashboards [JavaScript, R, Rshiny, Python, Plotly/Dash]

Decision Support

Surveillance & Reporting Dashboards [Java, Metabase, PostgreSQL]

Results

Secure & Standardized Collaboration Portal

GDIT developed the OAMD Portal for CDC's Office of Advanced Molecular Detection to enable role-based access control to shared data and computing resources.

Scalable Molecular Surveillance Infrastructure via Elastic Cloud Computing

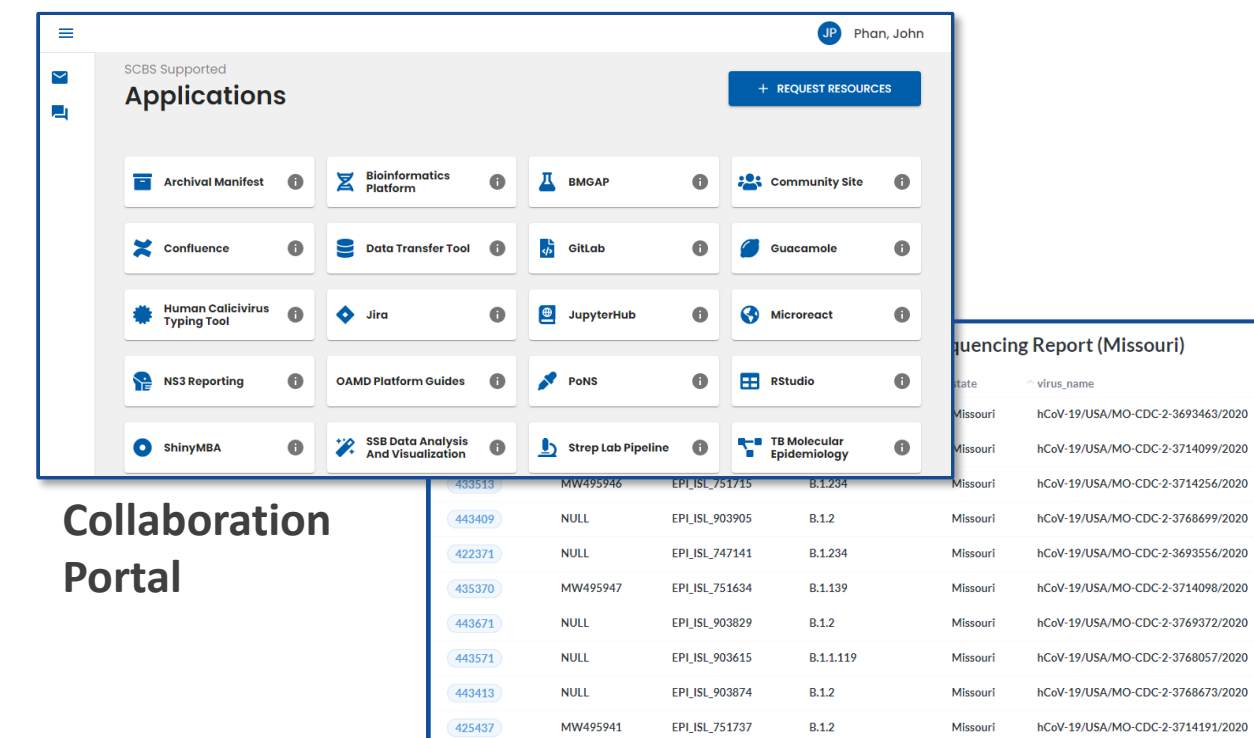
GDIT implemented an AWS-based elastic HPC cluster enabling dynamic scaling of NGS pipelines for CDC and external stakeholders in support of national COVID-19 surveillance.

SARS-CoV-2 Data Visualization

GDIT provisioned multiple on-prem and AWS cloud-based tools for analysis and visualization (NextStrain) to support the CDC's SARS-CoV-2 Sequencing for Public Health Emergency Response, Epidemiology and Surveillance (SPHERES): <https://nextstrain.org/groups/spheres>

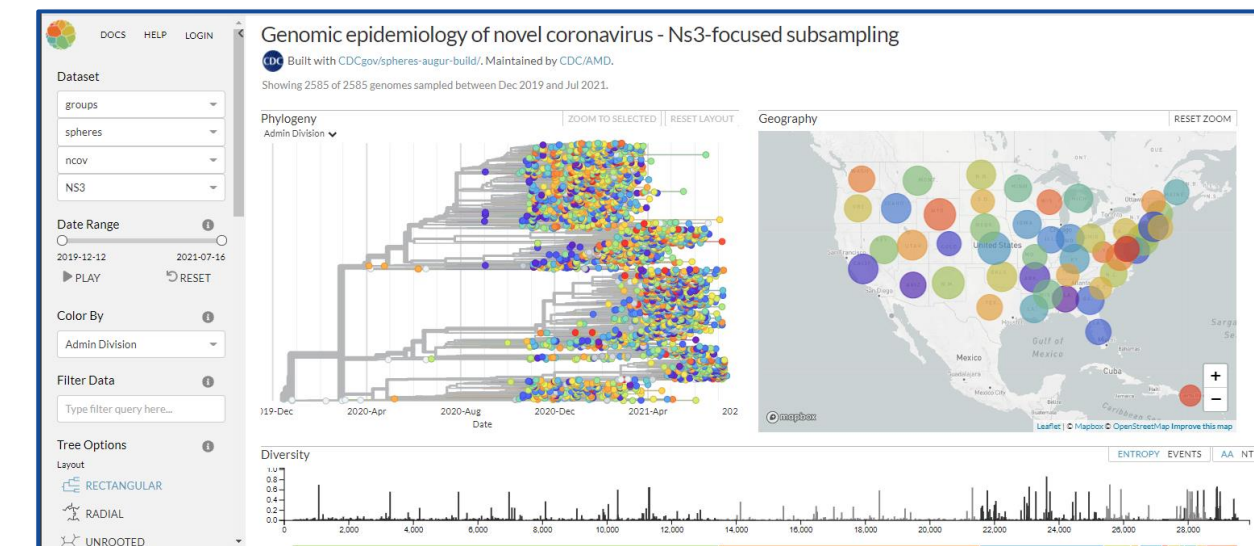
Reporting, Monitoring & Decision Support

GDIT developed the National SARS-CoV-2 Strain Surveillance (NS3) Dashboard, an access-controlled dashboard for state labs to view and download metadata associated with SARS-CoV-2 samples submitted to the CDC for analysis and to enable decision support for external partners.



Collaboration Portal

NS3 Dashboard



Data Visualization

Conclusions Modern large-scale public health responses require advanced bioinformatics and scientific computing capabilities with integration of diverse technologies and expertise.

Alignment of technical expertise and insights into stakeholder workflows provides users with solutions that accelerate and optimize parallelized computing, visualization, and decision support.

Nationwide collaboration support for CDC and public health partners enables COVID-19 clinical sample analysis at scale to meet the demands of variant analysis.

Leveraging established shared services infrastructure enables rapid deployment and adaptation of tools for COVID-19 pandemic response.