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14-16 May 2019

Stockholmsmässan, Sweden

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Designing a Weather Service

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Introduction

SEDRIS

- The Synthetic Environment Data Representation & Interchange Specification (SEDRIS) Meteorological and Oceanographic (METOC) specification is relevant to industry, academia, and government implementers.
- The METOC specification is feature rich and includes climatology, wind, solar energy, humidity, weather, clouds, atmospheric forecasts and observations, ocean observations, bathymetry, and more for a variety of land, sea, air, and space simulation applications.
- A major drawback to using SEDRIS is not so much with SEDRIS, but many of the data sources in use are dated perhaps from the peak of SEDRIS development about 15 years ago to as far back as 50 years.

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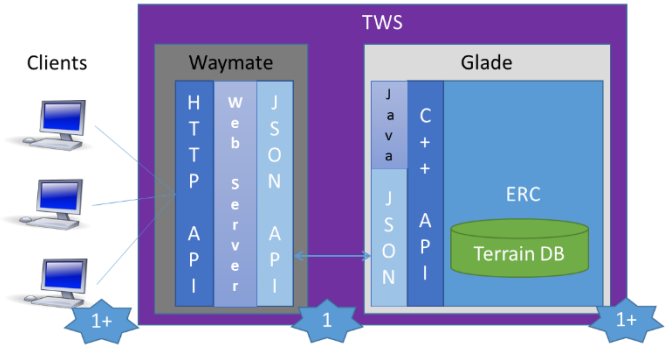
Approach

- Terrain Web Service (TWS) was presented at ITEC 2017.
- TWS converts the One Semi-Automated Forces (OneSAF) Environment Runtime Component (ERC), based on SEDRIS, into service called Glade which is provisioned on-demand, sitting behind a single Application Programming Interface (API) web service called Waymate.
- TWS provides a loosely-coupled mechanism for simulators to interact with web services to get consistent answers to synthetic environment related questions.
- The concurrently maturing concept of the Synthetic Training Environment (STE) is building its own One World Terrain (OWT) synthetic environment, perhaps not based on SE Core or SEDRIS.
- Clime proposes an alternative method to TWS or ERC for providing weather data which is not dependent on SEDRIS or SE Core related data.



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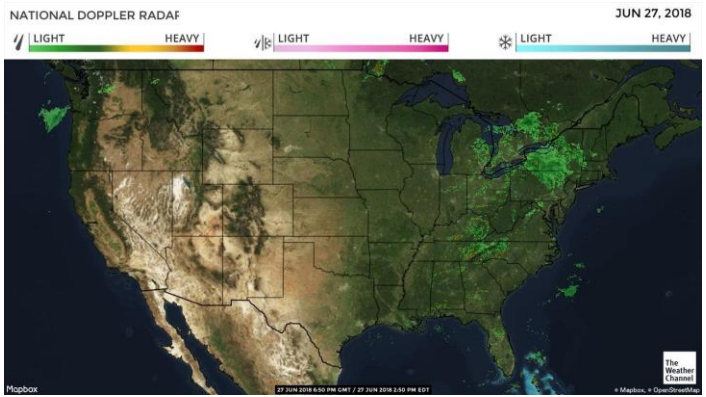
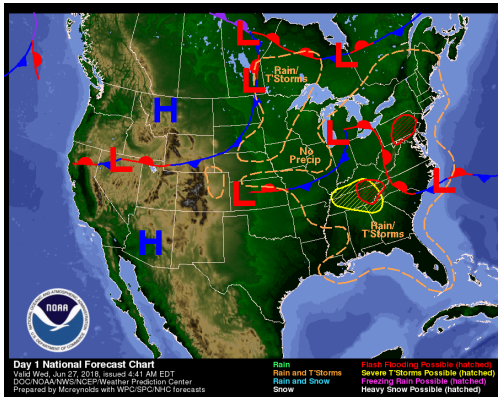
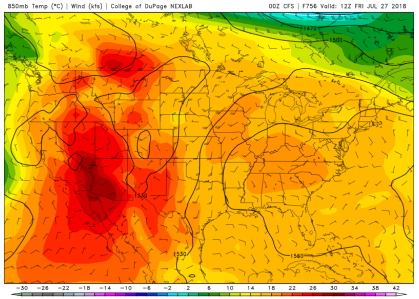
Objective



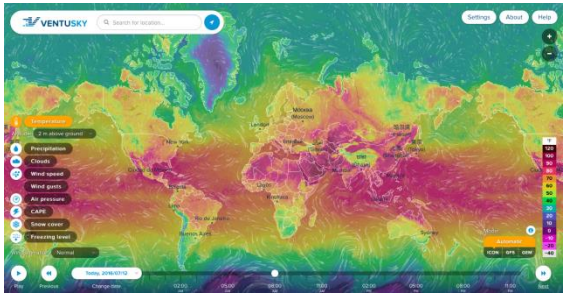
Precipitation



Pressure and Storms



Wind map with temp in °C



Complex Data Queries

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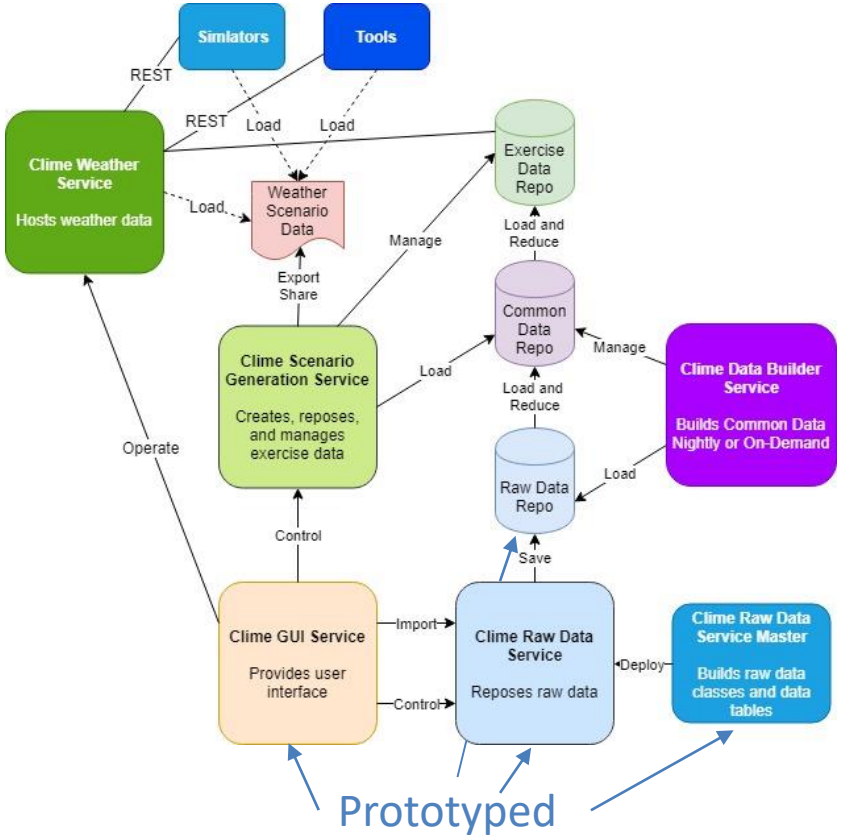
Objective

Design Clime to be a completely data driven tool to satisfy simulating weather data needs, importing data from authoritative sources, mapping or formulating the data to suite needs, and closing data gaps.

- ***Domains****: live, virtual, constructive, and gaming domains are diverse, requiring different fidelities of information for land, sea, air, and space.*
- ***Disciplines****: training, testing, experimentation, acquisition, research, and mission rehearsal M&S domains have similar needs with different descriptions for representation, access, accuracy, editing, concurrency, forecasting, retention, repeatability, and sources.*
- ***Data Sources****: accommodate various authoritative international and home-grown data source repositories representing METOC information for on- or off-line for importing, exporting or real-time access.*
- ***Representation****: data products include raw data through data products and include data tables and graphics.*
- ***Collaboration****: customers desire to collaborate and share information for the purposes of review, interoperability, consistency, and saving time and money.*

Notional Architecture



- **Clime GUI Service** provides configuration, status, and administration capabilities to users.
- **Clime Weather Service** provides a consolidated REST API with a preferred, standardized approach for querying weather information at runtime, provides interfaces for M&S systems.
- **Clime Raw Data Service** assists with gathering and saving raw data.
- **Clime Raw Data Service Master** assists with building Java classes and data tables for handing data sources.
- **Clime Data Builder Service** reposes source, formatted, and reduced data and views for data query.
- **Clime Scenario Generation Service** builds exercise data repositories and exports weather data.

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International Data Sources

https://openweathermap.org/history - provides an API to get current and historical weather data by location for temperature max and min, pressure, humidity, wind speed, etc. in a JSON format for free or fee based on usage. Provides open source tools to display data on maps, prototyped live feed.

https://aa.usno.navy.mil/data/docs/RS_OneYear.php - provides sun and moon data such as sunrise, sunset, transit times, civil twilight, lunar phase information as a data table for free.

https://darksky.net/dev/docs#response-format – provides an API to get historical, current, or forecast weather data to include temperature, pressure, snowfall, wind speed and direction in JSON for free or fee depending on usage.

https://www.ncdc.noaa.gov/cdo-web/ - NOAA provides worldwide weather datasets for over 100,000 historical sensor data feeds (30+ years) and over 2,000 active sensor data feeds.

https://www.cpc.ncep.noaa.gov/products/global_monitoring/temperature/global_temp_accum.shtml - NOAA Climate Prediction Center data provides global max and min temperatures files and was used for our initial prototype.

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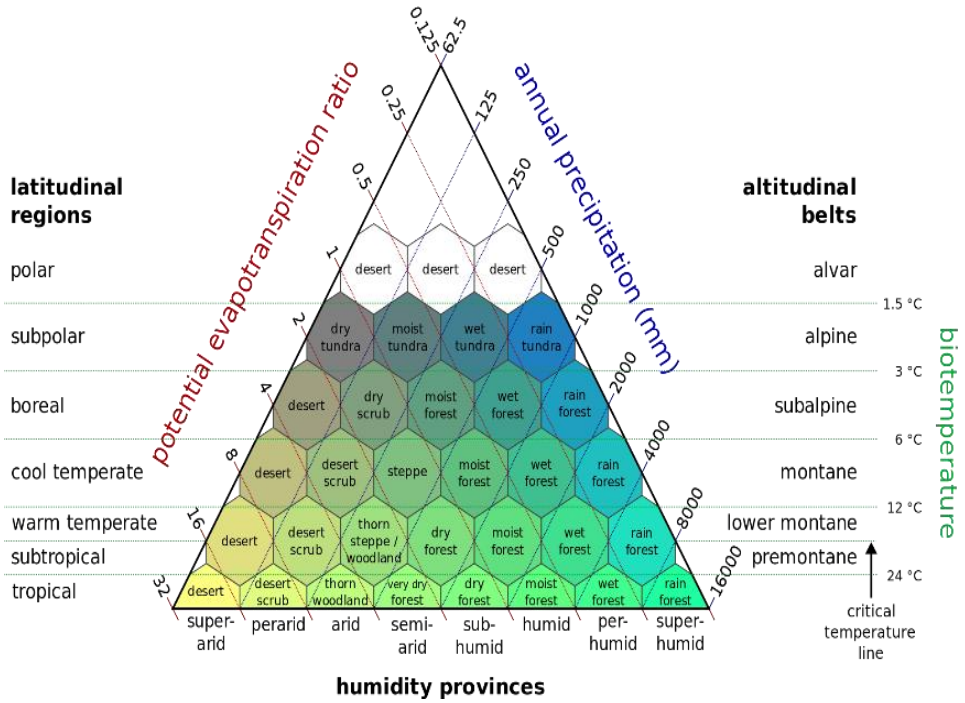
Data Abstraction

- Not all data is raw, it is sometimes abstracted for models or human comprehension
- Need to create a unified data model to ease the querying process across different data sources
- The Spring framework was prototyped successfully to include SQL, JPA, H2, and JPQL capabilities that unify and query data
- The Life Zone Classification System is an approach to abstract climate zone data



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Conclusion

- The Clime design approach includes capabilities to share and edit data, generate graphics, tap into live feeds, and host imagery. We prototyped reading CPCGlobal2017 files and connecting to an Open Weather Map data feed.
- The functionality and performance factors for those features influenced us to experiment with techniques to best balance querying a database versus working with the Spring software framework.
- The approach involves importing open source datasets into the configuration managed database for data at rest. We expect open source data to meet 71% of our existing requirement to meet or exceed current METOC capabilities.
- For data gaps, the data may need to be manually entered, we may revert to using SEDRIS, find another data source, or calculate data based on weather patterns.
- We prototyped bringing data into the JPA framework, and then wrote normalized data tables back to the physical database as needed.
- Our initial intent was to align data with legacy capabilities such as SEDRIS METOC, but our result was to instead generate new data models due to the breadth, depth, quantity, and quality of newer data sources with better relevancy and higher fidelity open source information.
- Even though there are some data gaps, the quality, ease of access, and concurrency of open source data exceeds our ability to get the equivalent function from SE Core or SEDRIS.

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Thank You

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Backup Material – Use Cases