Extending Tripal
for Display and Management of Diversity and Breeding Data

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Objectives

A. Show how Tripal can be used to associate genomic data with germplasm
B. Demonstrate Tripal’s extensibility & flexibility

Case Studies

- Marker Allele data
- Germplasm Characterization
- Gene Networks

Preface

All of the customizations you are about to see are completely optional. Tripal’s first goal is to be as out-of-the-box as possible and provides a large amount of functionality built-in.

Furthermore, Tripal & Drupal provide administrative interfaces allowing for a surprising amount of customization to be done through the web interface.

Although I am one of the core Tripal developers, I started out & still am a Biological website administrator who chose Tripal of her own free will.

Marker Allele Data

Store marker assay results for
- Characterization of diversity
- Marker Assisted Selection

With a focus on making it intuitive for breeders.

1. Use Core Tripal to store the markers & allele calls

   • Markers can be entered individually or in bulk via the GFF3 Loader
   • Each marker will be given its own page

2. Create a Materialized View to compile marker allele data into a single table

   Reasoning:
   • Faster & easier to query
   • Ensures other groups can use my functionality even if their data is stored differently

   Implementation:
   • Materialized views can be created via the tripal administrative interface
   • And updated the same way
Specialized Views and Figures to compare & summarize the data

- Add summary charts to marker, germplasm/stock and project pages
- Accomplished using the Drupal Highcharts module, a custom view and field
- This functionality can be done entirely through the Tripal administrative interface

Each researcher dynamically chooses the germplasm of interest
- Markers and associated allele calls are displayed for chosen germplasm

Created using a custom view with custom fields and filters
- Programming needed to create the custom fields & filters
- Custom view created via the Drupal Views administrative interface

All of the previously mentioned customizations can also be done programmatically
- Using The Drupal & Tripal Application Programmer’s Interfaces (APIs)
- This allows custom functionality to be packaged into extension modules and shared among Tripal sites

The ND Genotypes module contains most of the previously mentioned functionality
- A free, open-source Tripal Extension Module
- Also includes a Tripal Bulk Loader template to make it easy to load your marker allele data in the expected format
- The materialized view ensures you can use this functionality even if your data is stored differently

Available at drupal.org/project/nd_genotypes

Breeding program crosses, varieties, outside germplasm & wild genotypes
To provide
- Breeders with the information needed to design crosses
- Students with context for the germplasm they were studying
Specialized pedigree figure to visualize relationships

- Pedigree is drawn on each germplasm/stock page
  - Based on relationships in chado
- Users can click nodes for more information & double-click to collapse subtrees
- Legend provided to make relationships clear
  - Hovering over a relationship also provides a descriptive sentence

Add a new pane to an existing page type (i.e., stock/germplasm) by registering a new template with Drupal & Tripal
  - Custom content goes into this new template
  - In this case, the template calls the javascript functions needed to draw the tree
- Relationships are supplied to the javascript via a JSON webservice
- Popover content can be customized at the template level

The Tripal D3 module contains the pedigree tree functionality
  - Includes the javascript required to create the tree as well as the template needed to display it on the stock/germplasm page.
  - Additionally, this module exposes the JSON webservice providing the relationship information from chado

Available at drupal.org/project/tripald3

Create custom tables within chado to store networks

- Chado doesn’t support complex networks
- Thus custom tables were created to store this information
- By creating these tables through the Tripal administrative interface you automatically have
  - Views integration for custom listings
  - Bulk loader support for loading tab-delimited data

Create a Network Page type

- Creating a custom content type gives you complete control over
  - The add/edit form provided to your users
  - The page displayed on your website
  - Where the data is stored
- Tripal provides a number of APIs targeted at easing the creation of new content types
  - Add relationship, property & database reference forms
  - Handle page title & url customisation
**Networks Module**

- Functionality has been developed and is being used in GeneNet Engine
- General Release is being developed.

**Other Extension Modules**

- Quite a few Extension modules have already been developed for Tripal
- A listing of extension modules can be found on the Tripal website (tripal.info/extensions/modules)

**Other Extension Modules**

**BLAST**

**PhyloTree & QTL Modules**

**Resources & Modules**

*Modes mentioned in this talk:*
- ND Genotypes: drupal.org/project/nd_genotypes
- Tripal D3: drupal.org/project/tripald3

*Tripal Customization Resources:*
- Drupal API: api.drupal.org
- Tripal API: api.tripal.info
- Tripal Developers Handbook: tripal.info/documentation/2.x_developers_handbook
- Tripal Example Module: included in Tripal Core download

**Tripal API**

- Found at api.tripal.info
Conclusions

- **Tripal is Highly Customizable!**
  - Administrative interface allows for extensive non-programmatic customizations
  - 1000’s of free themes exist to customize the look of your site
  - Drupal & Tripal API provide a framework for any customization you can imagine
  - Customizations can be shared through extension modules/themes!
- **Tripal does not need to be customized to provide extensive functionality to your group**
  - Especially with the use of already developed extension modules.