

Forest Management Planning

A FOSS4G Approach

Free Open Source Software 4 Geospatial

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Presenters



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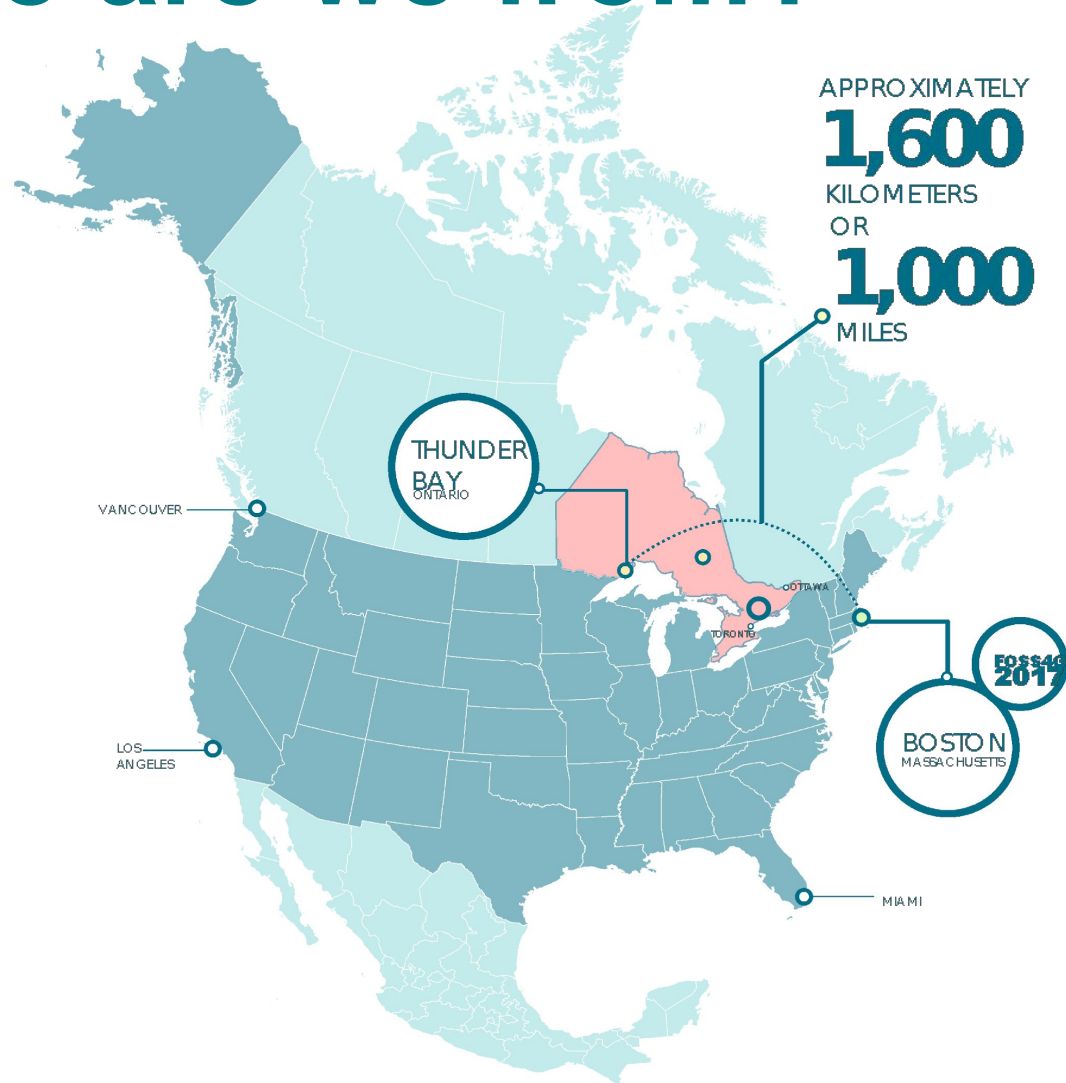
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Our Forest Management Planning FOSS4G Story

- The Challenge
 - Who we are
 - Forest Management in Ontario
 - Complexity of Data Management
 - “Our data needs a good Librarian”
- Our Solution
 - Vision
 - Architecture, Function, Components
 - Implementation
 - Lessons Learned
 - Future

Where are we from?



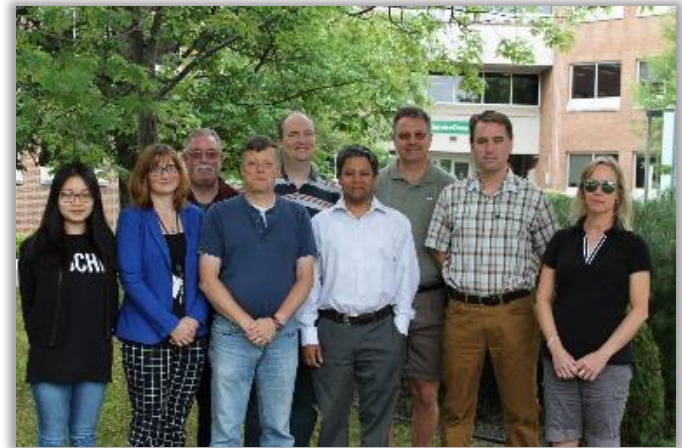
The Ontario Ministry of Natural Resources and Forestry

The Ministry protects Ontario's biodiversity while promoting economic opportunities in the resource sector and supporting outdoor recreation opportunities.

- **Program Areas**
 - fish and wildlife, management of Ontario's Crown lands, parks and protected areas, forest fire protection
 - **Ensure the sustainable management of Ontario's Crown forests**
 - **Develop and apply geographic information to help manage the province's natural resources**

Information & Analysis Unit

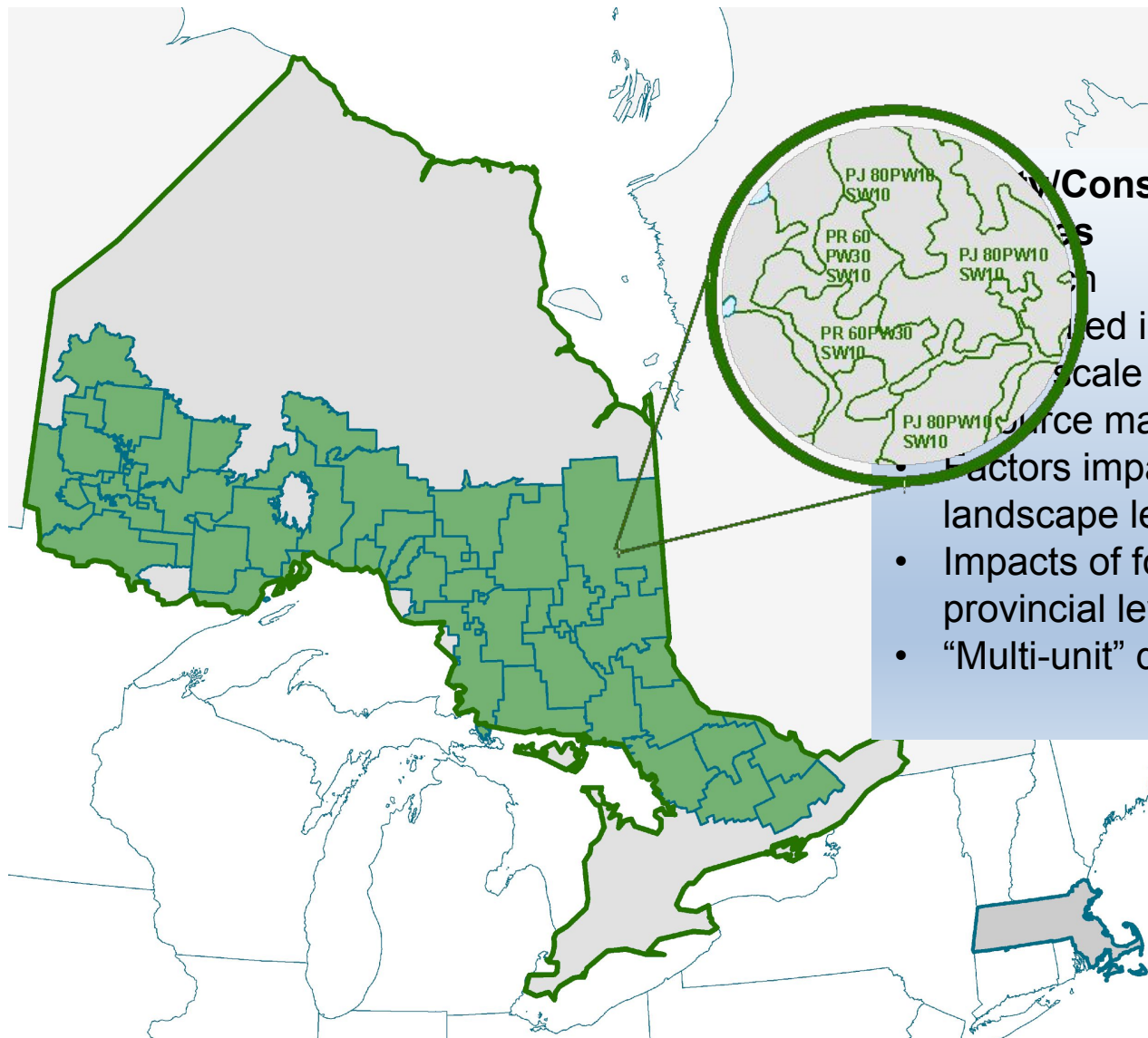
- Regional IM policy implementation lead
- GIS services
- Resource Analysis services
- Staff
 - GIS
 - IM
 - Resource Analysts
- 2 sister units
 - Similar work
 - Collaboration opportunities
 - Common business processes -> Common systems



Forest Management in Ontario

- Over **150 years** of forest industry in Ontario
- Diverse industry (raw and value added... pulp/paper, lumber, fuelwood, furniture, engineered wood products, etc.)
- Industry plans, harvests and renews
- **Government regulates and monitors**
- Billions of dollars in annual economic value
- Tens of thousands people working directly and indirectly for the forest industry

Complexity of Forest Data Management



Consolidation/Scale

...ed interests

... scale and trend through time

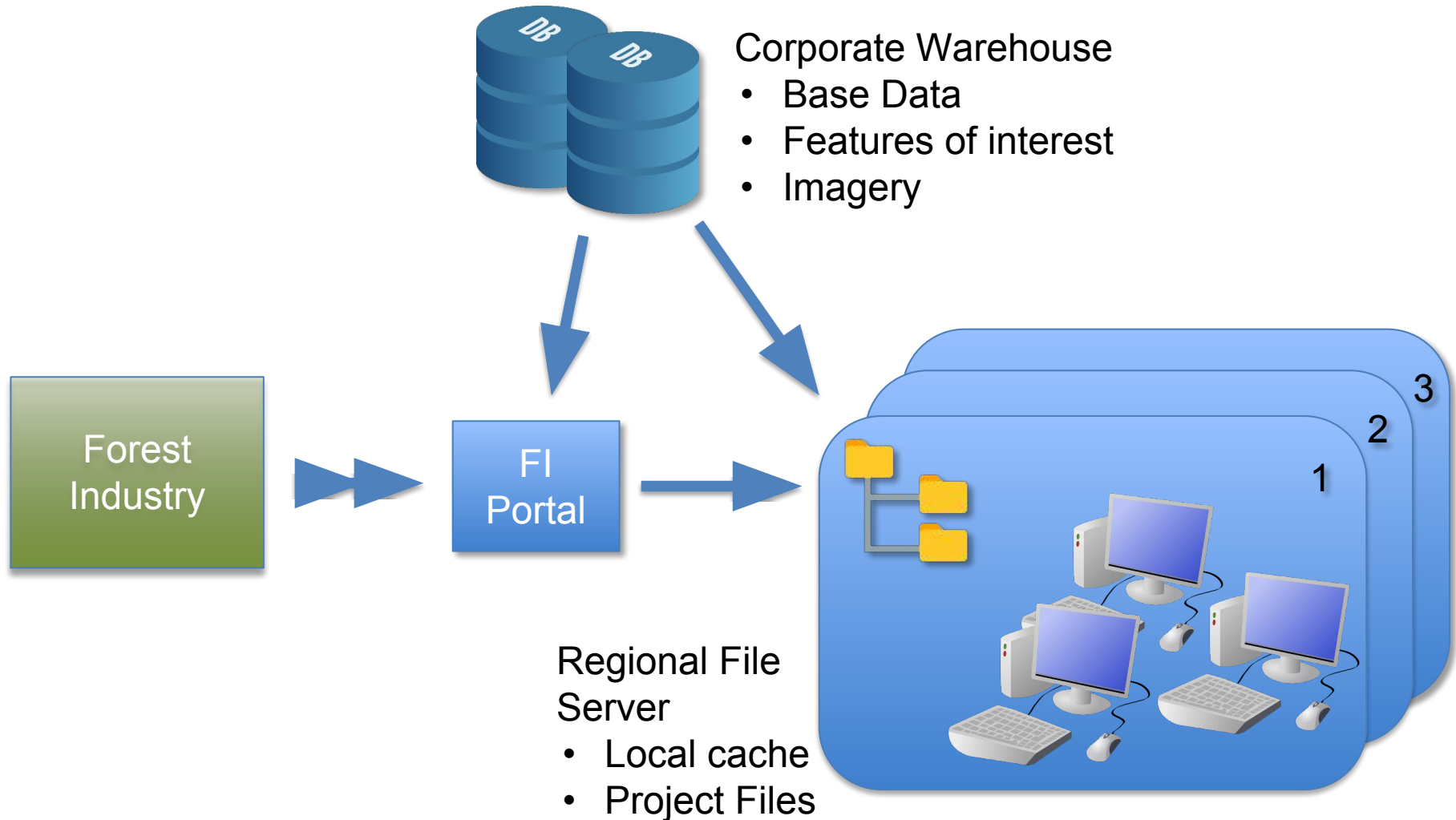
... resource management questions

... Factors impacting forest health at a landscape level

- Impacts of forestry at a regional or provincial level
- “Multi-unit” data/information requests

Forestry Data Management System

Current Regional File Based System

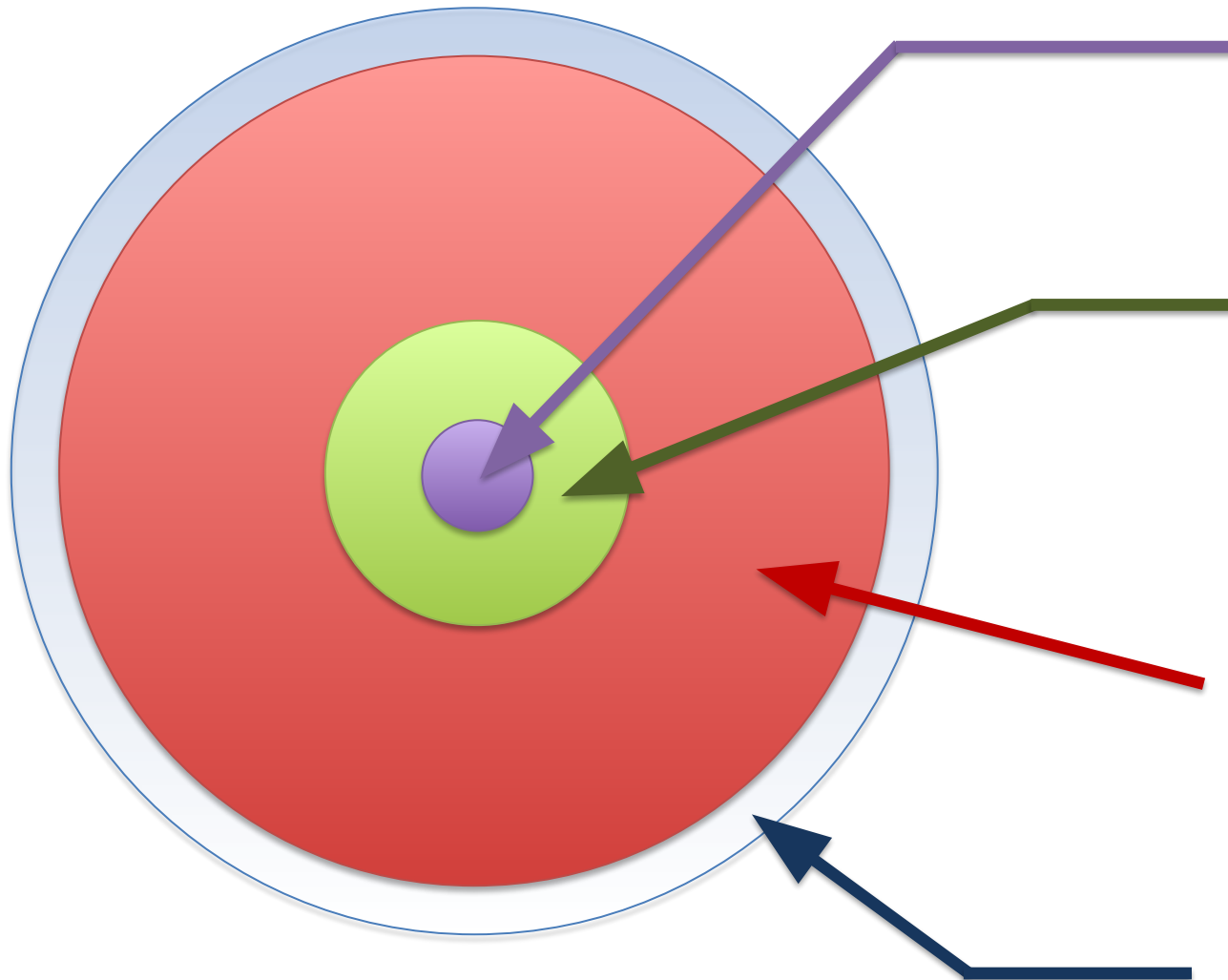


The Challenge

1. We needed a way to optimize internal business processes so that we could:
 1. Free-up staff from mundane data management to focus on complex mapping analysis
 2. Generate information more efficiently
 3. Generate new information e.g. landscape level
 4. Be more responsive to requests for data and/or analysis of data

“Our data needs a good librarian”

Business Risk:



Sandbox:

- proof of concept
- single user
- no risk

Business Trial

- business application of concept
- 10 users
- low risk



Workgroup

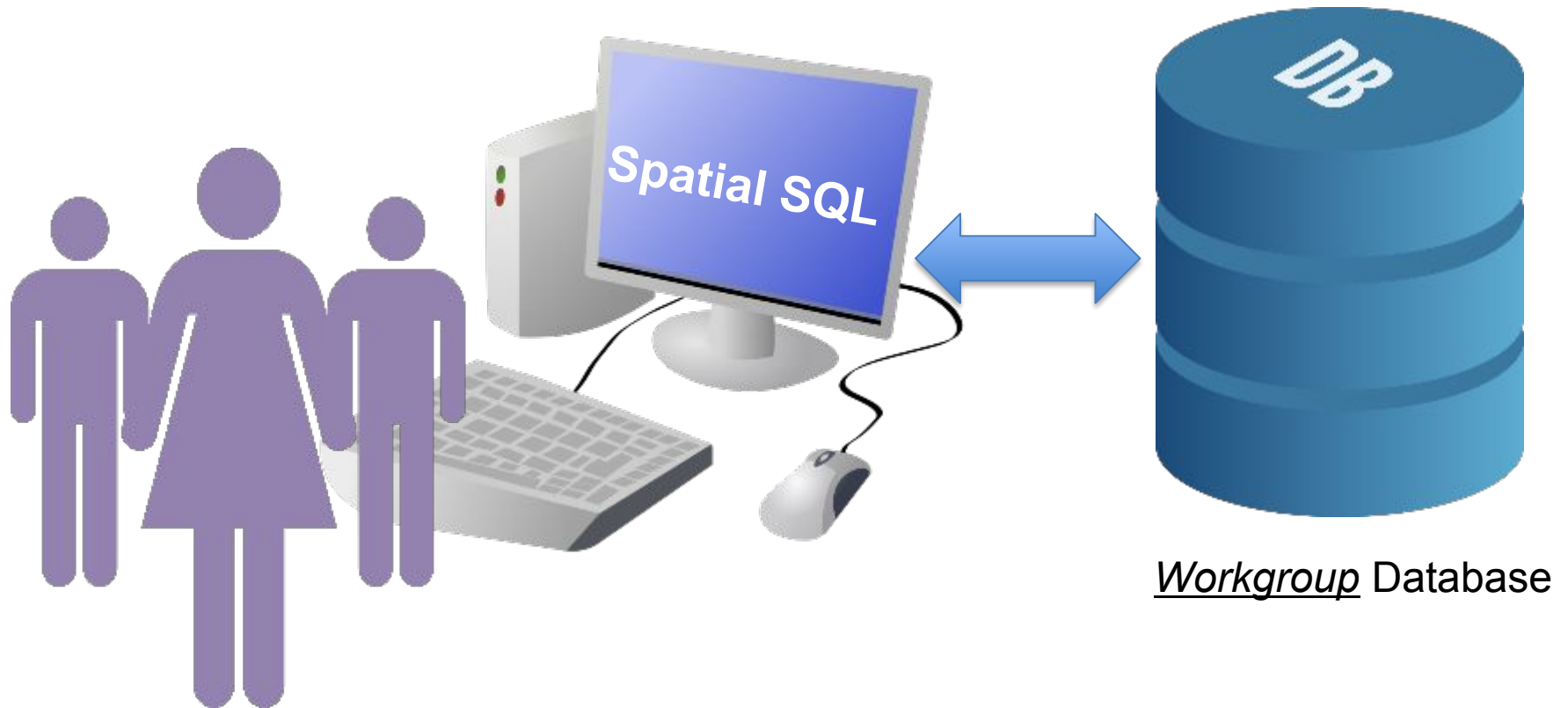
Pilot_(target)

- “limited” production,
- 40 users,
- moderate risk

Enterprise (optional):

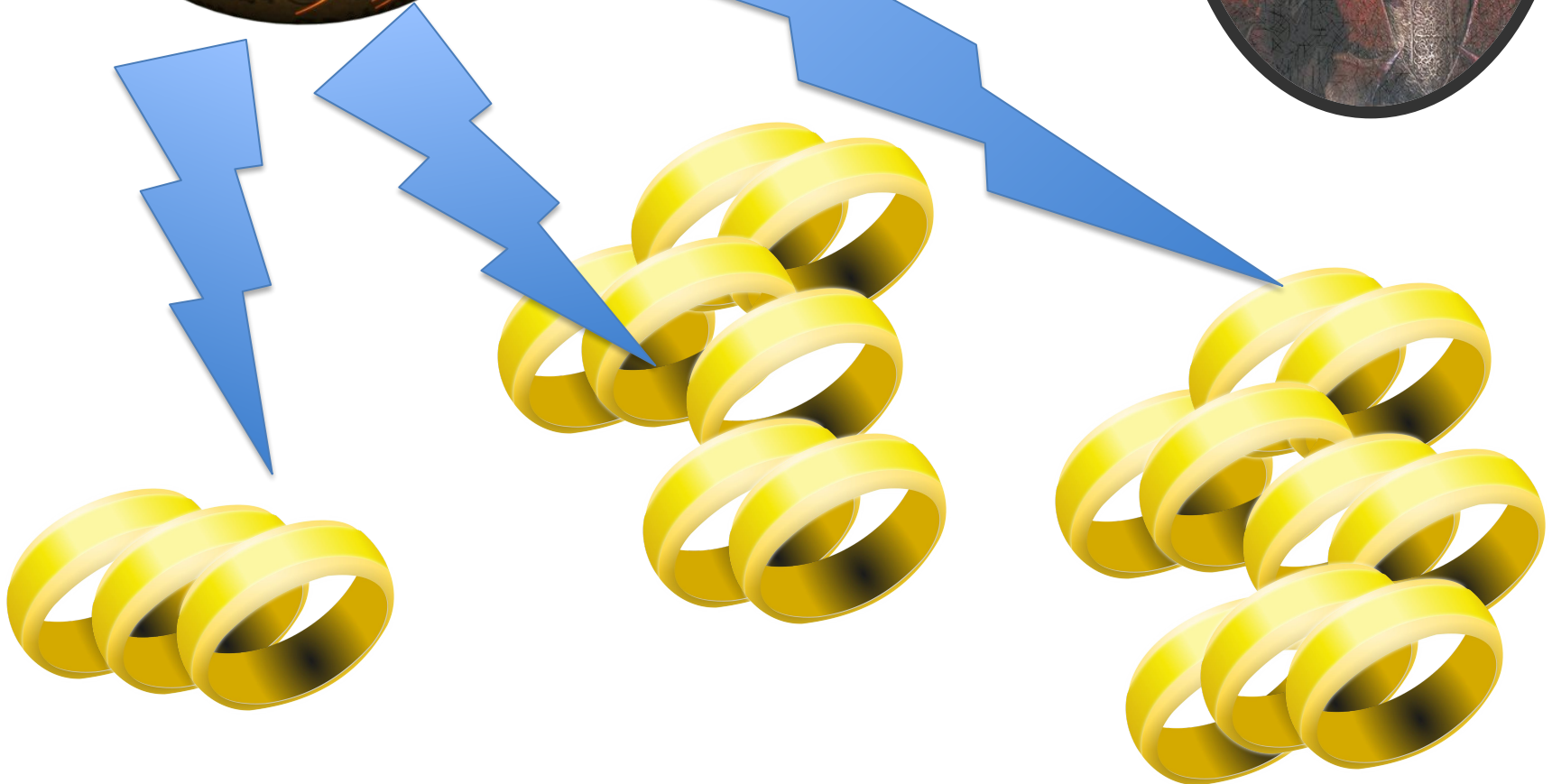
- full production
- 4000 users
- high risk

Vision



Multiple Users – One Query Language – One Database

A Tolkeinesque view of what we want...



System Conceptual Design

Forest Information Portal



Error/Warning Report

Checker

Loader

Forestry Data (tabular and spatial)

+ Shared Views
+ Stored Procedures
+ User Views

Foreign Data Wrappers
Prov. Spatial Data
Fisheries
Climate
Etc.

Exports

- File Geodatabase
- Modeling inputs
- SQLite

Ad-hoc Queries via Desktop Tools

- QGIS
- ArcGIS
- PGAdmin
- MS-Access
- Tableau
- Etc.



Local DB

Prov. DB

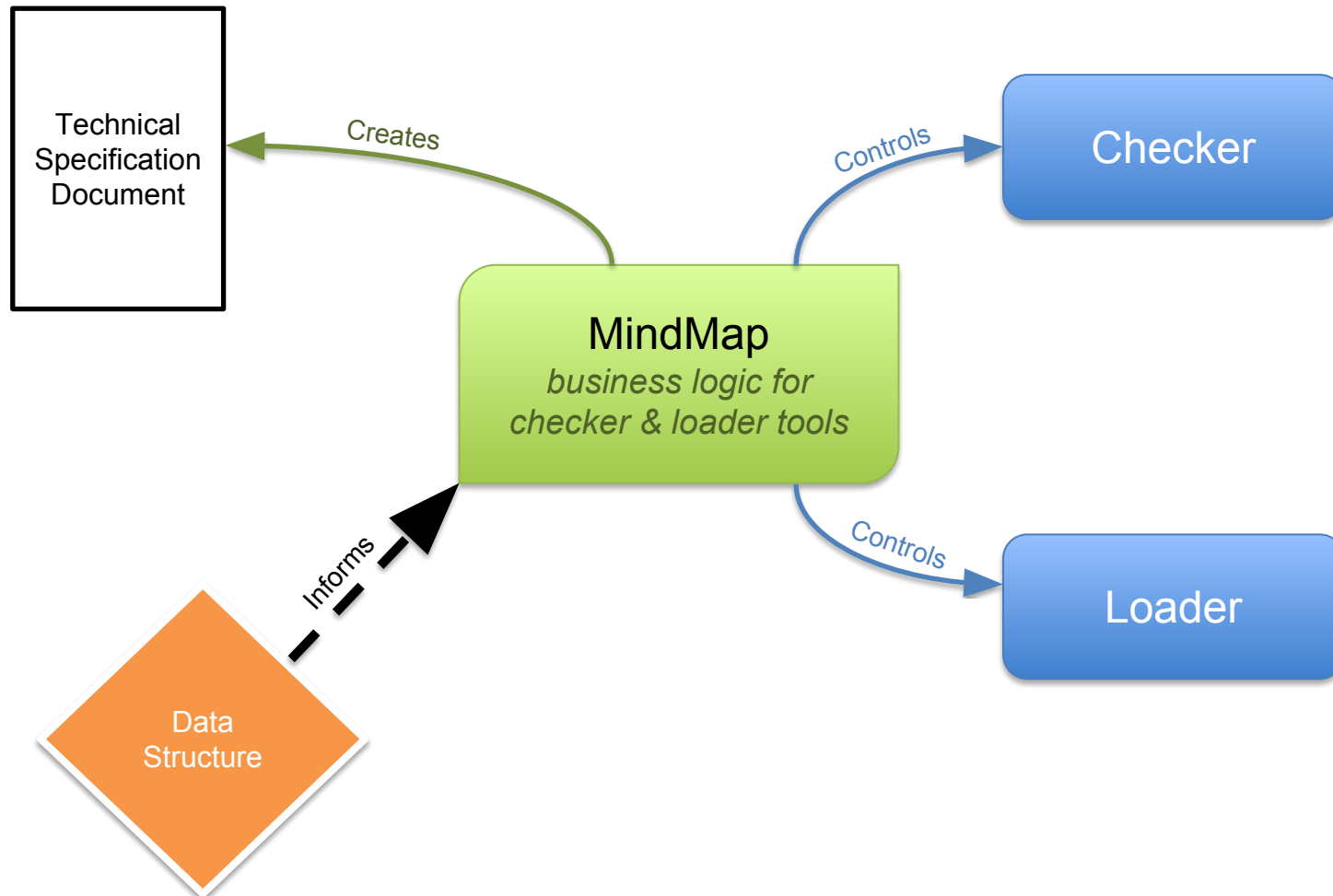
Fisheries DB

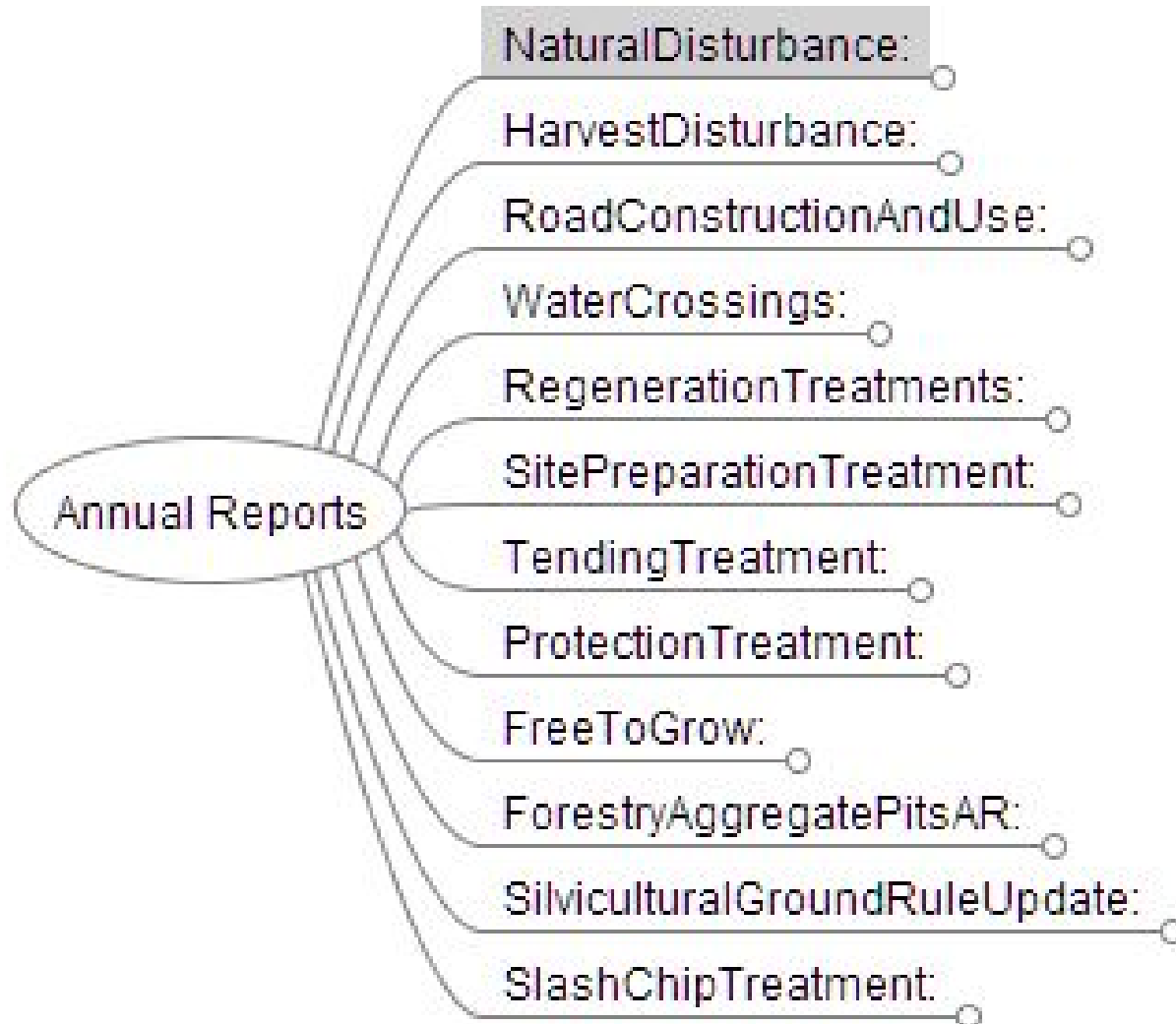
Climate DB

(Env. Can)

Etc.

Innovation: Mindmap







NaturalDisturbance:

- name NaturalDisturbance
- spatial_reference 26916
- geometry_type Polygon
- path AnnualReports
- alias Natural Disturbance (NDB)
- fields
 - NDEPCAT:
 - VOLCON:
 - VOLHWD:
 - DSTBFU:

Annual information on fire disturbances is currently compiled by MNR Aviation, Forest Fire and Emergency Services in Sault Ste. Marie. The information is organized spatially into a GIS data layer based on fire sizes greater than 40 hectares. This information is required by the Licensee in order to assist in the development of the natural depletion information for the annual report submission.

Definition

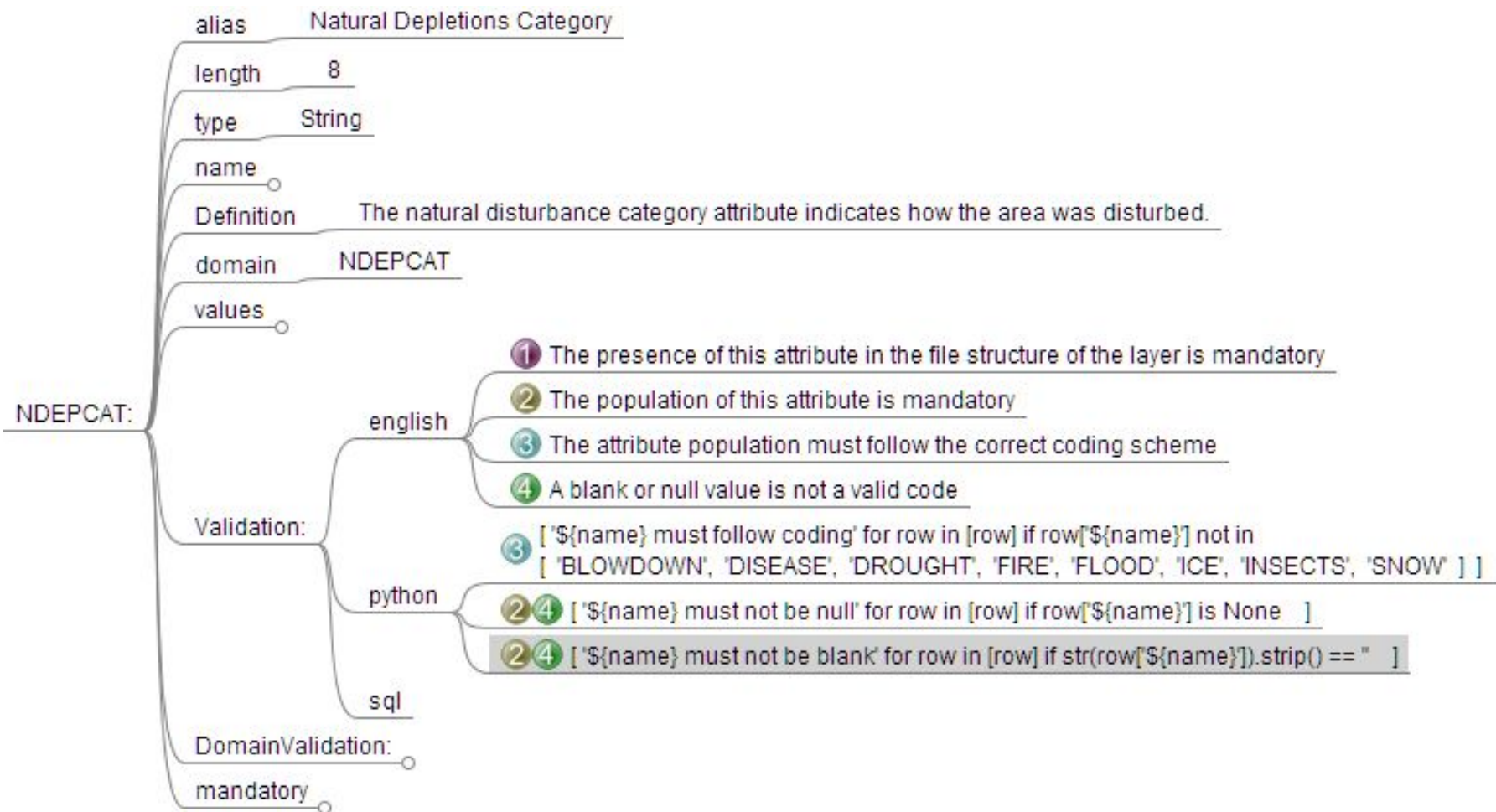
The polygons in the geospatial data layer represent the exterior perimeter of the forest fire only (i.e., gross fire area) and do not include any large interior green (i.e., unburned) areas. The fire perimeters do not identify the severity of the burn nor represent any mortality information or other impacts on forest cover.

Perimeters of the individual polygons may be based upon GPS mapping or post-fire digitizing of paper maps. Since in some cases the fire perimeters were digitized from hand drawn maps at various scales, the accuracy of the data is considered to be in the range of +/- 100 metres. In cases where perimeter maps were insufficient or missing, a buffer proportional to the size of the fire was created.

shortname NDB

Validation:

- english
- python
- sql



System Architecture:

Forestry Portal

- HTML
- Javascript

Checker

 Python

- HTML/CSS
- JSON

Loader

 Python



- JSON
- GDAL/OGR


Forestry DB

 PostgreSQL + PostGIS

- Spatial SQL

Exports

-  PostgreSQL
- Spatial SQL
- Desktop GIS formats
-  SQLite (SpatialLite) Database

 **Business Logic:**
Freemind .mm

Desktop “Operational” Components



- OSGeo4W or ArcMap/ArcPY
- PGAdmin III

Development/Maintenance Components



- IDE: Geany/Pycharm/PyWin
- Business Logic: Freemind
- Project Management: Redmine
- DB Admin: PGAdmin III

Server Components



- PostgreSQL DB
- PostGIS
- Apache or IIS
- OSGeo4W
- Redmine

Why Open Source?

1. Easy to acquire in scoping stage
2. Simple architecture
3. Free to implement
4. Large and active support community
5. Staff with open source experience + the capability to implement. Didn't need to rely on an external IT "partner"
6. Scale (PostgreSQL a better fit for workgroup-class than COTS Oracle – too expensive, and Access – poor multiuser)
7. Performance: Open Source GIS components (QGIS, PostGIS+PostgreSQL) faster at specific task than COTS solution
8. Ease of deployment: OSGEO install takes care of dependencies
9. Version stability: longer availability of required components
10. Cross-platform/platform independence

Current State

- **Data Librarian Role:**
 - Over 80 million forest data records loaded (~50% total for province)
- **Data loading:**
 - Component vetted and in full production
 - Submission handling decreased from days to minutes per submission
- **System implementation:**
 - Training delivered to tool operators May 2017
 - Data *checker* component code-complete July 28, 2017
 - Staff working in consolidated system as opposed to disparate systems

Key Lessons Learned

1. Grassroots exploration of innovative data management systems can work, but needs management support
 - We are self-supporting using open source, and the knowledge and expertise remains in-house and re-usable.
2. Admin level change access to the server is critical to development success (understanding risk model). Benefits outweigh risks.
3. The simplest solution is often the best solution
 - i.e. Unix Model: string together multiple simple and highly focused components. The complexity comes in the assembly of the components.
4. There are no relevant **functional** differences between COTS and open-source components.
5. Primary **organizational** barrier to FOSS4G implementation is an organizational structure not conducive to interdepartmental collaboration. Expectation that we are going to collaborate is being addressed via new business unit structures, and full support of open source projects.
6. Primary **individual** barrier to FOSS4G implementation is staff comfort with existing systems, NOT learning curve or technological barriers

Biggest Wins:

1. Automation

- Large efficiency gains (# of staff, time, # of business processes)

2. Abstraction

- Plain language business rules and “tools to make tools” – i.e. mindmap for business logic

3. Data Discovery and Access

- **Where is our data? 😊 It's in the database... (consolidation, data librarian role)**

Future

- Business initiative (corporate assessment) phase to last 5 years (2021)
- Load all “current” forest data (~240 million records) by fall 2017 + approximately 1 million+ new records/year
- Expand “data librarianship” responsibility to other program areas (i.e. fisheries, wildlife, etc.)
- Prototype derivative products in the workgroup environment:
 - i.e. Caribou Screening Tool, Forest Management Plan Review, Historic Climate Analysis Tool
- Investigate addition of larger scale “enterprise” production environment to supplement current workgroup level database

Questions and feedback



Thunder Bay Team



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APPENDIX

Detailed Vision

Workgroup level, consolidated, server based, spatially enabled relational database

- **“One” database**
 - Provincial extent
 - Spatial and tabular data
 - Link to existing databases (read-only) e.g. Provincial Spatial Data
 - Load other data holdings by business line
- **One query language**
 - Spatial SQL
- **Connect with desktop tools**
 - Tableau, Excel, Access etc.
 - Hybrid GIS – ArcMap desktop/FOSS4G backend or open source frontend and backend
- **Direct Users**
 - All section staff, regional science staff
- **Indirect Users**
 - Regional Staff, District Staff, Others
- **Data Management**
 - Proactive data loading
 - Automated data processing
 - Project ready datasets
 - Flexible/customizable data storage to account for diverse and changing business needs
- **Information Generation**
 - Leverage automated “information product” production

**Automation requires common business processes
(Documented, vetted and approved)**

Detailed System Contents

- **Local Data**
 - Active forest management planning data
 - Historic forest management planning data
 - Temporary user data for analysis
- **Integrated Functions**
 - Submission Checker – checks industry data inputs
 - Exception Reports provided to ministry and forest industry partners
 - Data Loader inputs validated submissions into consolidated database
 - Export file generators - create generic desktop user file exports and forest model inputs
- **Related Products (leveraging base system)**
 - Caribou Screening Tool (habitat impact assessment)
 - Historic Climate Analysis Tool (trend analysis)
 - Forest Management Plan Review Tool (commenting system)

