**Technical
Overview**

Neronet

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Technical Overview

Neronet

Project 2
Toolbox for managing the training
neural networks (Pyry Takala)

CSE-C2610 Software Project
Aalto University

November 2, 2015

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Introduction

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Neronet is a framework designed to facilitate the specification, submission, monitoring, control, analysis and management of many different computational experiments. It has three components:

1. A job scheduler for Linux clusters (either SLURM or Jobman)

2. `nerojob` – a program designed to be launched by a job scheduler in cluster nodes to monitor, analyse and control single experiment jobs and their environment in tandem with `neroman`

3. `neroman` – a user run daemon that acts as the Neronet information server and user interface to provide Neronet's features

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Introduction

The following slides contain three diagrams:

1. *Job management* – the associated problem domain
   spheres and how the system components are related to
   them
2. *Journey map* – the journey or work flow of a typical
   system user (a computational researcher) and the steps
   in which the Neronet tools are designed to be used
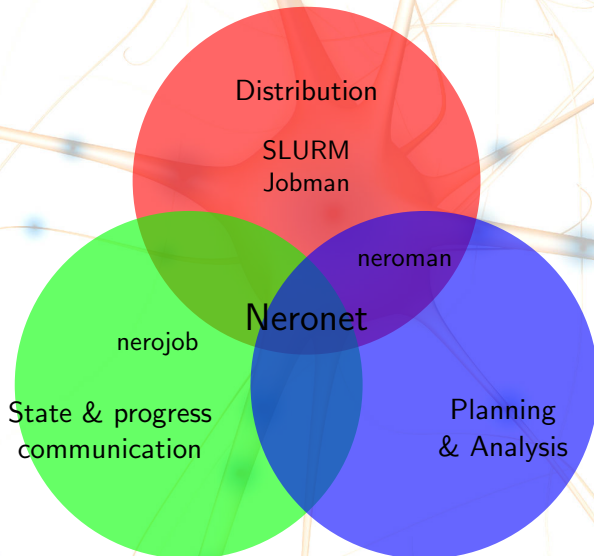3. *Basic use case* – A sample basic system use case
   description

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Job management

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Journey map

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Basic use case

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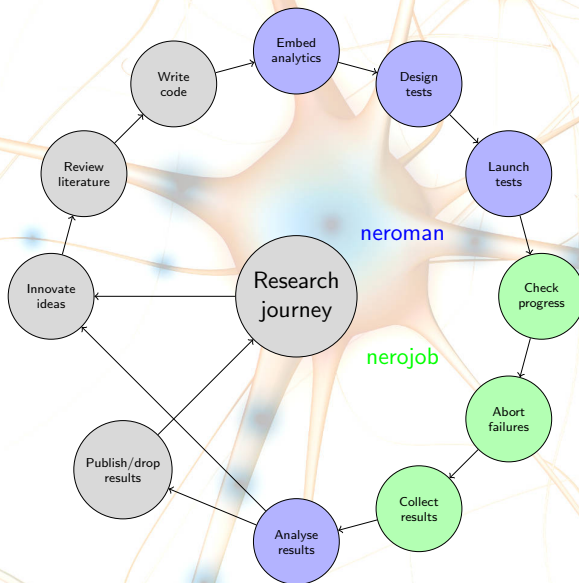
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- **User**: A computational researcher
- **Goal**: To test how well a new design works with several different configuration options and parameter values
- **Preconditions**: SLURM cluster and Neronet setup, code and analytics developed and test inputs setup in Neronet compatible manner
- **Basic flow**:
  1. Specify a batch of *nerojobs* in the *experiments Excel* with parameters, inputs and other configurations
  2. Run neroman --launch 20-28 to dispatch the jobs to the SLURM setup with autogenerated sbatch scripts and arguments
  3. Receive and check progress notifications from email
  4. See near realtime updates in the *results Excel* of analytics variable updates
  5. Receive final results data and updates to the job excel as configured
  6. Analyse, reiterate and/or publish results
- **Post conditions**: Computational experiments have been conducted in a very straightforward, effective and researcher friendly fashion

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- Both `neroman` and `nerojob` are Python programs run with just the researcher's privileges on any modern *nix
- SSH is used for intercomponent communication (user's existing ssh keys, ssh configs and privileges are used)
  - `neroman` and `nerojob` exchange data and files via their CLI and Python interfaces
  - `neroman` and `nerojob` communicate with SLURM and/or Jobman using their APIs and/or CLIs
- The system is ment to be very easy to setup, lightweight and the usability good for several types of uses.

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Communication

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SLURM / Jobman

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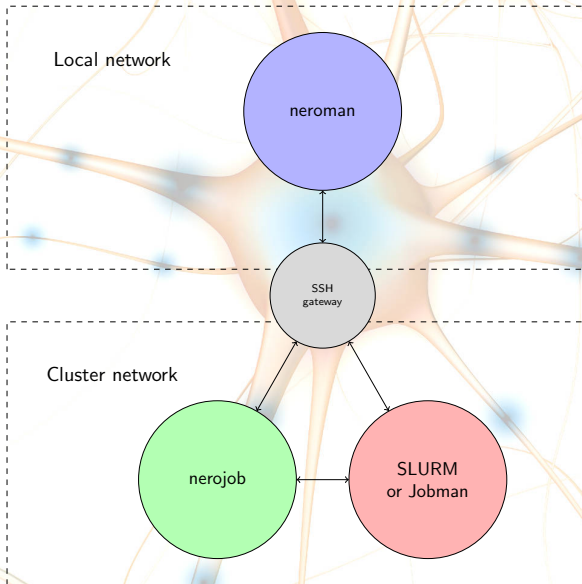
- ▶ Both are existing standard job scheduling systems for Linux clusters.
- ▶ They have both CLI and API interfaces and are expected to be presetup by research systems administrators.
- ▶ SLURM is currently used by Triton and CSC. Jobman could be easily setup for the gpu cluster used by deep learning researchers at Aalto.

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neroman

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- A daemon administered and configured by the researcher herself
- Should be run on a system with two way SSH access to the cluster nodes
- Key functionality
  - Facilitate and standardize experiment specification
  - Batch submit experiment jobs to SLURM/Jobman with autogenerated job scripts (`sbatch`)
  - Send email notifications with progress data
  - Facilitate monitoring and control of running jobs
  - Autocollect key job results into a researcher specifiable format (f. ex. Excel)
  - Facilitate experiment analysis and history management
  - Lightweight and extendable with custom functionality
  - Configurable via YAML files

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nerojob

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- A program ment to be started by SLURM/Jobman on any modern *nix (cluster nodes) on job launch
- Key functionality
  - Fetch and send computing environment information to `neroman`
  - Monitor experiment job progress (parse output logs and data files (eg. CSV, JSON))
  - Autocollect and send information and data to `neroman`
  - Interact with SLURM/Jobman as specified (eg. autotermination based on poor experiment progress)
  - Lightweight and extendable with custom functionality
  - Configurable via YAML files

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- A server (`neroman daemon`) per user approach is chosen because
  - easy minimalist setup (easy to try)
  - no need for special privileges
- SSH is used because
  - it is an existing standard in most modern research systems and clusters
  - user's existing ssh keys and ssh configs provide an easy and effective way to provide safe networking
  - no need for network, port routing or privileges adjustments
- Python 3 is used because
  - available in most modern *nix systems
  - has good support for the system's needs
  - it is easy to learn and familiar to most computational researchers
  - Many research libraries use it (Scipy, Numpy, Theano, Lasange, Pylearn2)

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