Technical
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Neronet

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Technical Overview

Neronet

*Toolbox for managing the training
neural networks*

CSE-C2610
Software Project

Aalto University

November 4, 2015

Outline

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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. The Neronet family consists of three members:

1. Neroman – a user run tool that acts as the *Neronet frontend* and user interface to provide access to Neronet's features and functionality. It is the researchers workhorse.

2. Neromum – a Nerokid manager daemon that helps the family stay organized while the kids are playing in distant clusters, possibly in collaboration with a Warden that is predesignated to supervise and control the playing grounds.

3. Nerokid – a tiny creature that looks after your computational toy and reports to mum in case it breaks.

Introduction

In more technical terms:

- **Nerokid** is a program designed to be launched by a job scheduler or **Neromum** directly in a cluster node to monitor, analyse and control a single experiment job and its environment in tandem with a **Neromum**

- **Neromum** is a job scheduler, manager and communications agent designed to work by herself or with a standard cluster job scheduler such as SLURM, OGE or Jobman (a **Warden**)

- **Neroman** is a tool that acts as the *Neronet frontend* and user interface to provide Neronet's functionality by dispatching **Neromum**s in specified clusters or nodes with a bunch of jobs to do. The **Neromum**s in turn dispatch the jobs to the **Nerokid**s and then continue as communication intermediaries.
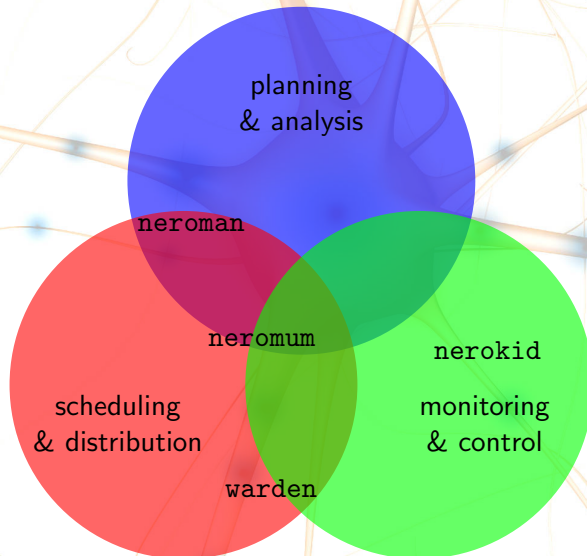
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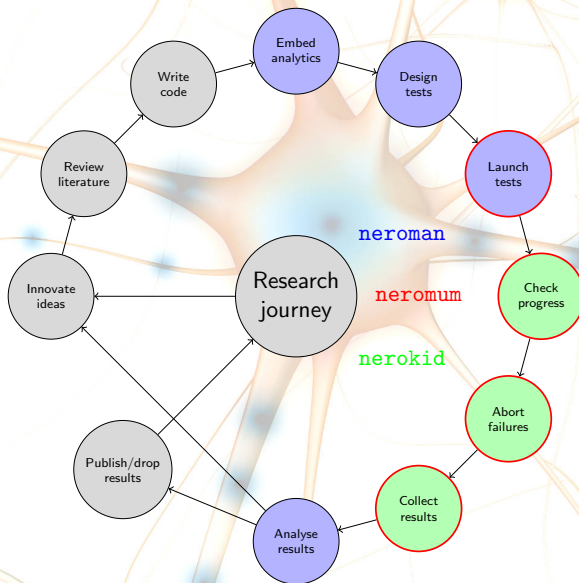School of Science
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Introduction

The following three slides provide a good introduction:

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

Job management

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planning
& analysis

neroman

neromum

nerokid

scheduling
& distribution

monitoring
& control

warden

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Journey map

Basic use case

- ▶ **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 Nerokids in the *experiments excel* with parameters, inputs and other configurations
  2. Dispatch the jobs to the SLURM setup with autogenerated `sbatch` scripts and arguments: `neroman --start 124-186` or `neroman --start 'tmod<1h'`
  3. Receive and check progress notifications from email
  4. Reconfigure some jobs in excel and restart them: `neroman --restart 'crashed,144-149,170,175'`
  5. Abort some others: `neroman --abort 'runtime>7200&&errorrate>0.40'`
  6. See near realtime updates in the *results excel* of analytics variable updates
  7. Receive final results data and updates to the job excel as configured
  8. 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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- All Nero components are lightweight Python programs run with just the researcher's privileges on any modern *nix

- SSH is used for communication between Neroman and Neromums (user's existing ssh keys, ssh configs and privileges are used)

- Sockets are used between Neromums and Nerokids

- Neromum communicates with any Wardens using their CLIs and/or APIs

- The system is ment to be easy to setup, lightweight and the usability good for several types of uses.

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Communication

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neroman

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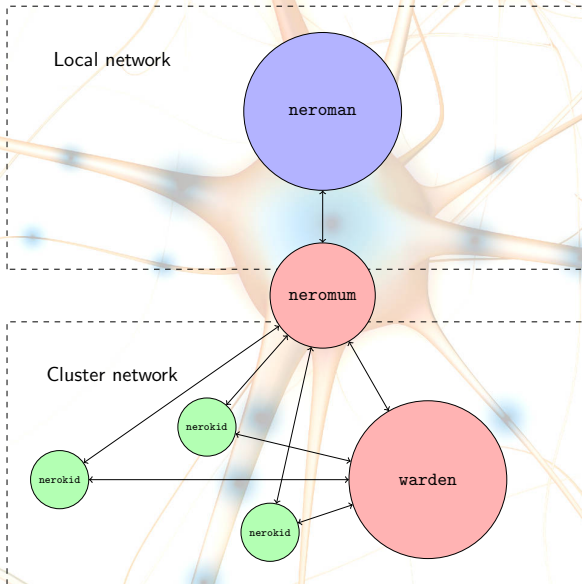
- A daemon administered and configured by the researcher herself
- Should be run on a system with two way SSH access to the cluster gateway or nodes where the Neromums are deployed
- Key functionality
  - Facilitate and standardize experiment specification
  - Batch submit experiment jobs to Neromums
  - 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

neromum

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- A daemon started and administered by a Neroman.
- Should be run on a system with two way SSH access to the Neroman and socket access to the nodes where Nerokids are deployed
- Collaborates with standard Wardens. SLURM is currently used by Triton and CSC. OGE is still used worldwide. Jobman could be setup for the CS gpu cluster.
- Key functionality
    - Receive and execute commands from Neroman
    - Communicate with any Wardens by autogenerating job scripts (eg. `sbatch`) and their CLIs and/or APIs.
    - Collect information from Nerokids, process and cache them, send them to Neroman on request
    - Transmit commands from Neroman to the Nerokids

nerokid

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- A daemon started and administered by a Neromum on any modern *nix cluster node to start and monitor computational jobs
- Key functionality
    - Fetch and send computing environment information to Neromum
    - Monitor experiment job progress (parse output logs and data files (eg. CSV, JSON))
    - Autocollect and send information and data to Neromum
    - Interact with the warden 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
  - fully customizable by the user herself
- SSH is used because
  - it is an existing standard in most modern research systems and clusters
  - user's existing ssh keys and 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, Pylearn, Blocks)

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