Reproducible complex analyses: Why Galaxy matters

Galaxy Australasia Workshop March 2014

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Outline

- Science and reproducible results
- What Galaxy is & why it matters
- Tool Shed – VCS for tools
- What's in it for you?
- Commodity reproducible analysis

Reproducibility

- Experimental findings that cannot be reproduced either by the researcher or independently are ***unlikely to be valid***
- Fundamental principle of the scientific method
- ***Reproducible analyses*** our focus
- Reproducibility gets harder as analyses get more complex

→ Challenges for scientists

- Commodity technologies
- Complex, large scale data
- Competing analysis tool ecology
- Intricate analysis pipelines needed
- Analysis → biological insight
- Manual steps not reproducible

Context: Sequence in research

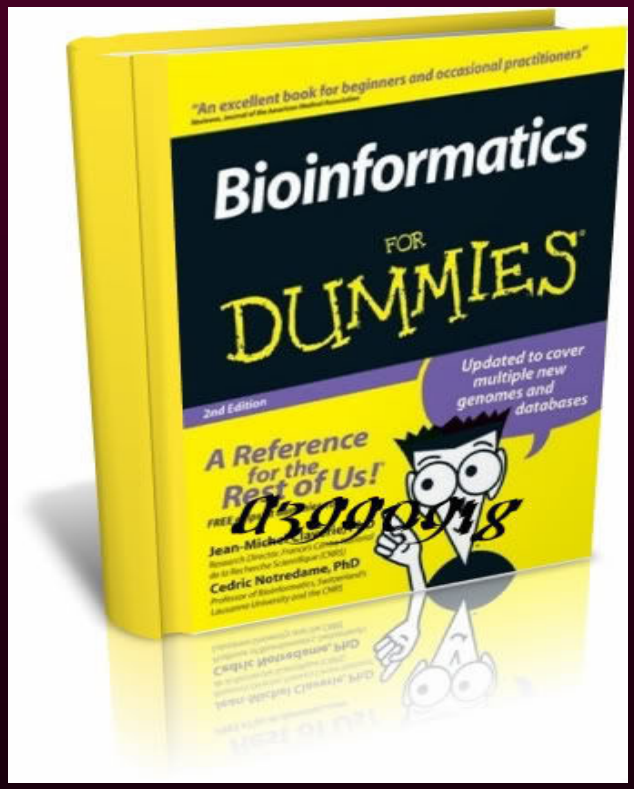
- $$$ → Human genome project
- Commodity molecular technologies
- MP short read sequencing
- DNA, RNA, miR, …. ChIP-seq

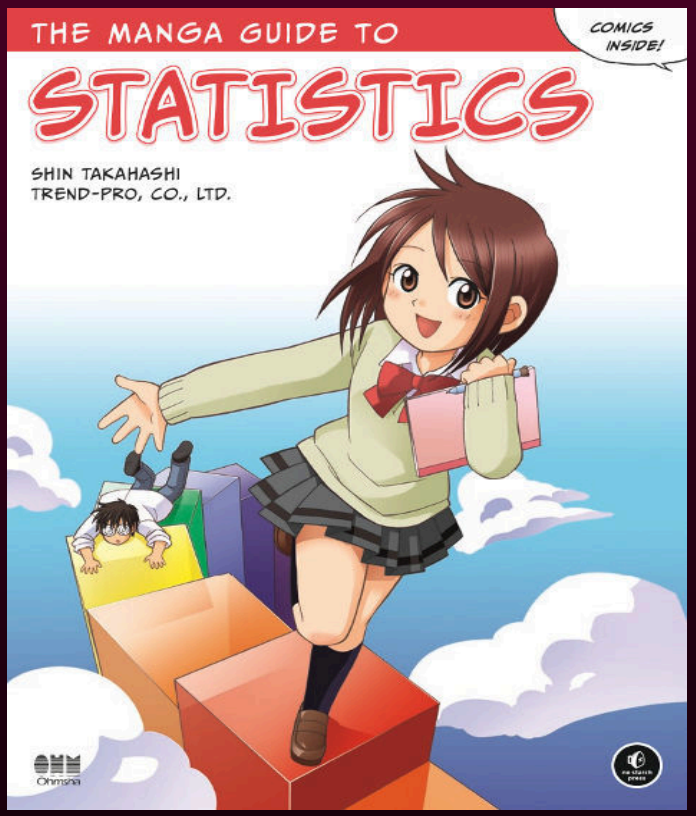
Very big genomic data

10@600 Gbase / day
60B 100nt reads

Raw data – A,C,G,T

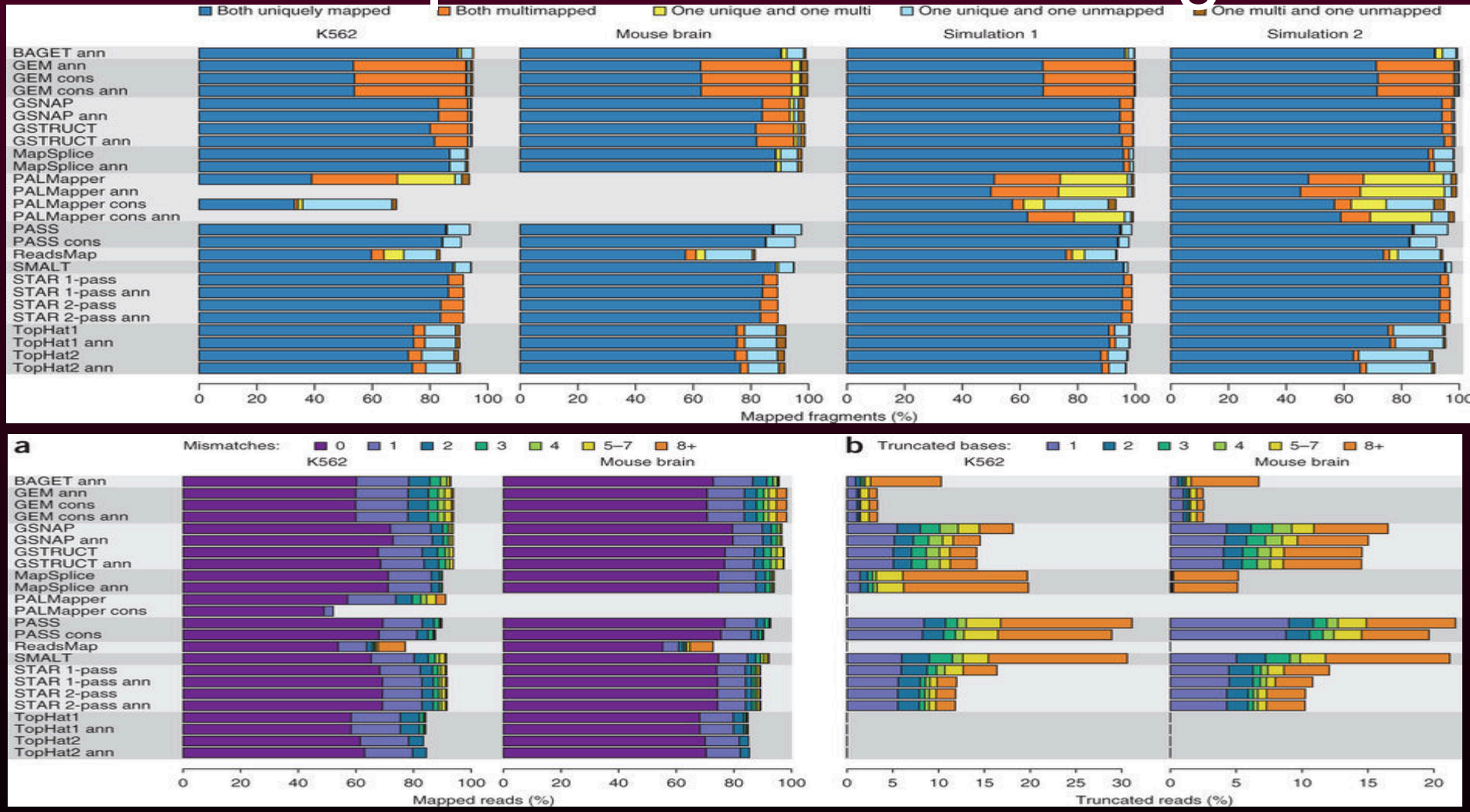
Biological insight requires:





Independent projects, all rapidly evolving

EG: 26 splice aware RNA aligners

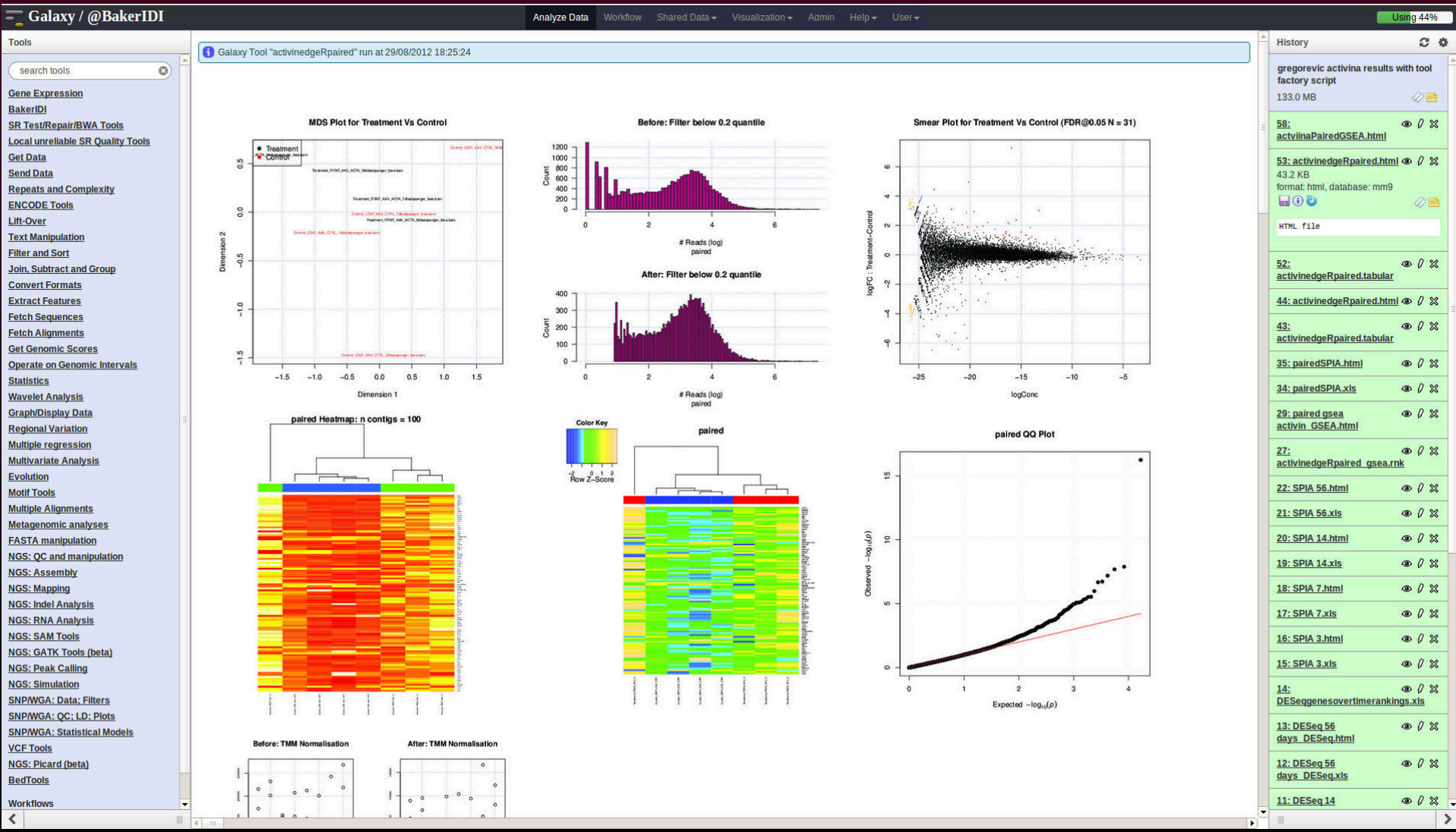


http://www.nature.com/nmeth/journal/v10/n12/fig_tab/nmeth.2722_F1.html

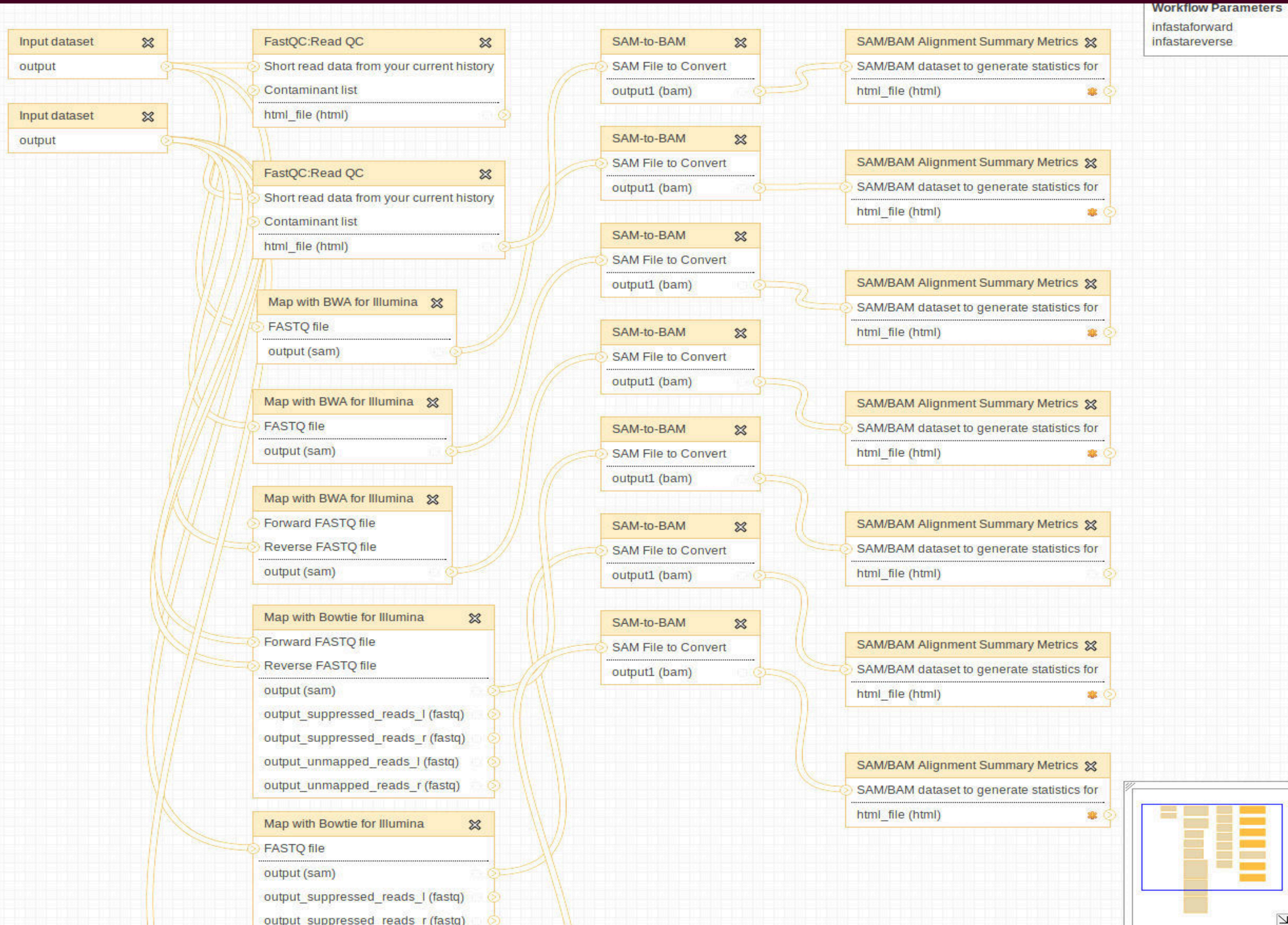
Outline

- Science builds on reproducible results
- **What Galaxy is & why it matters**
- Tool Shed repositories – VCS for tools
- What's in it for you?
- Commodity reproducible analysis

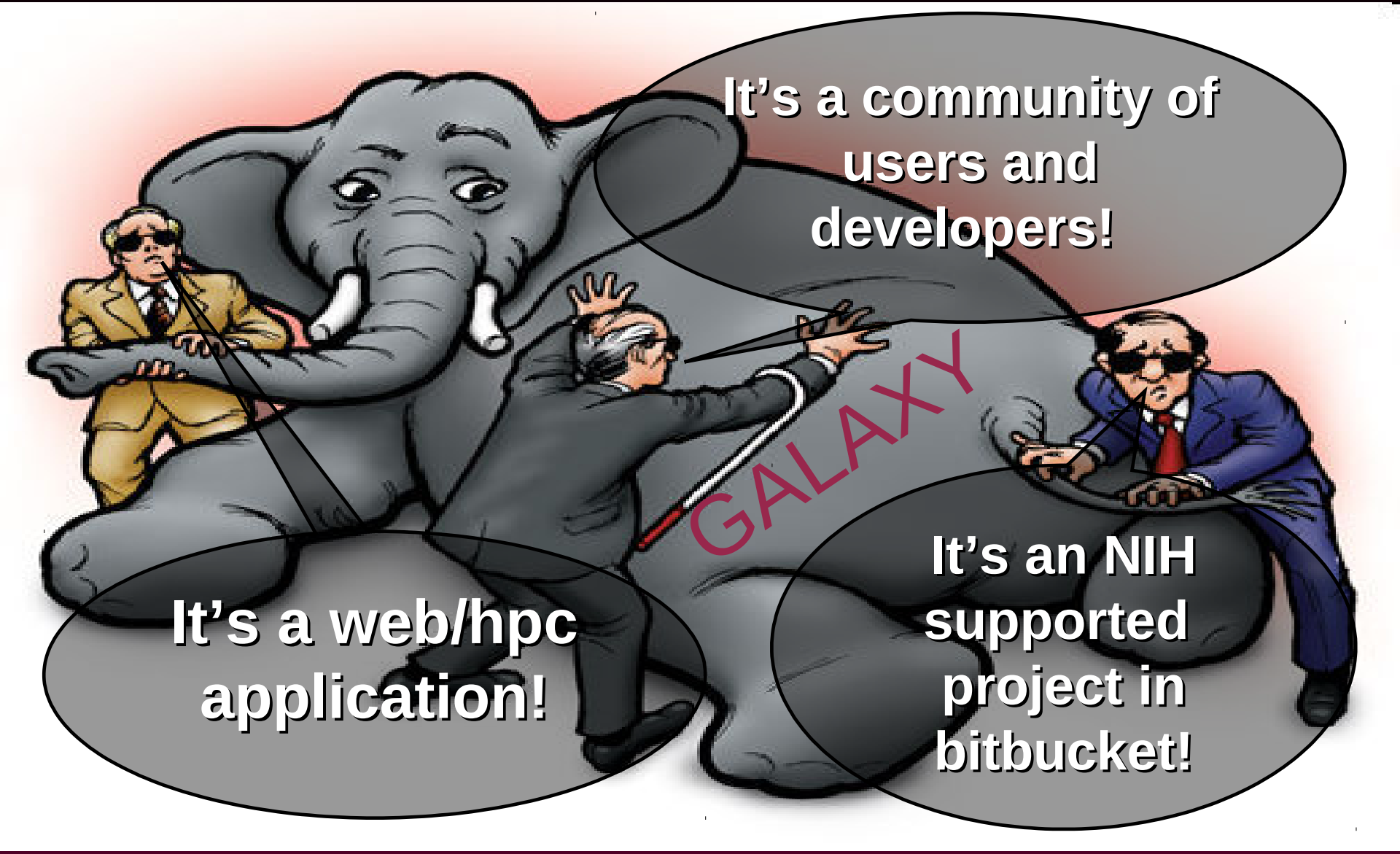
Galaxy looks like this



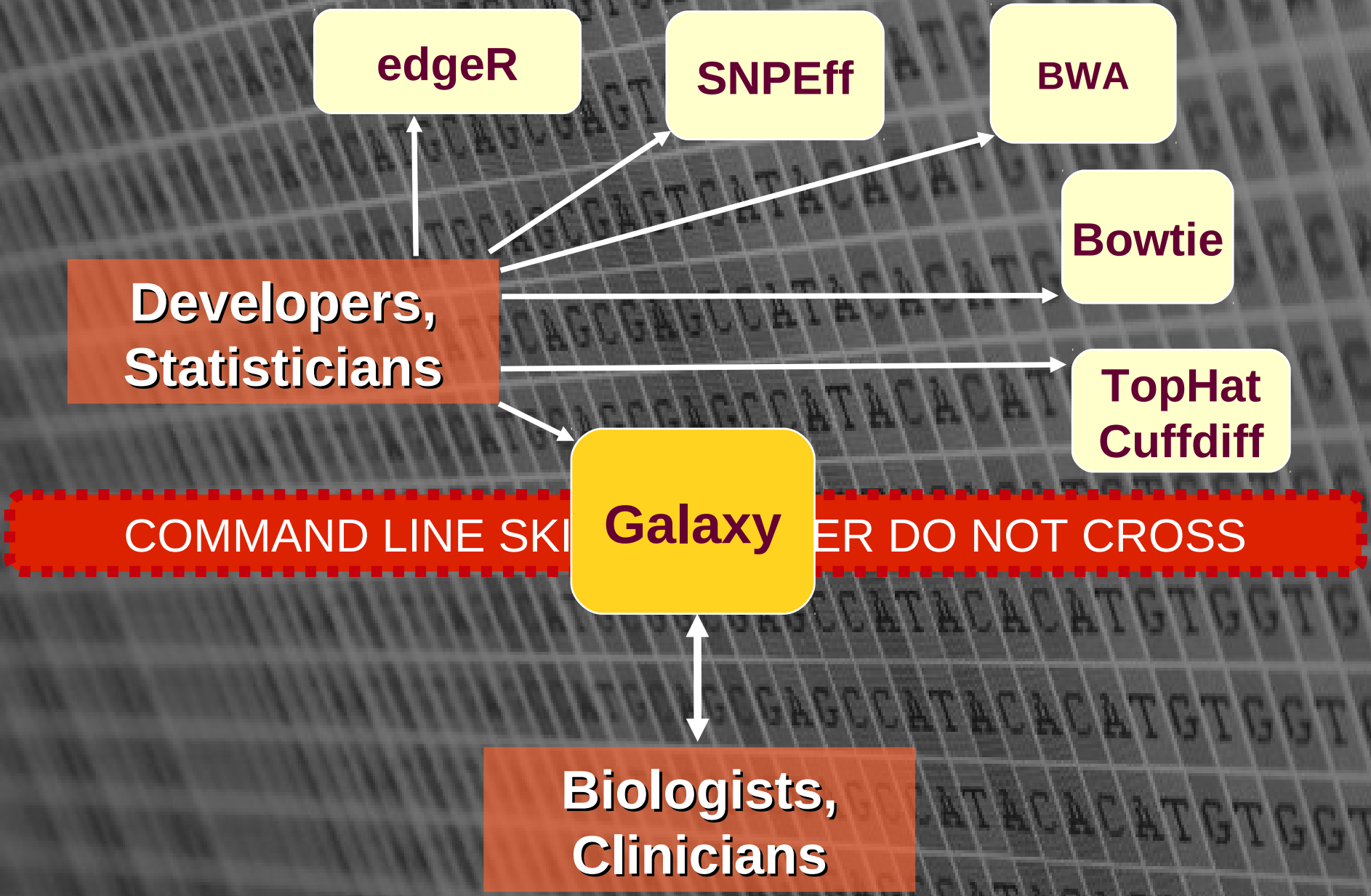
Sometimes like this



Depends on which bit you get



Where does Galaxy fit?



Why does Galaxy matter?

- Supports complex reproducible analyses
- Low entry barriers – uniform web UI
- Exposes popular tools
- O.S.: transparent, shareable research
- Engaged user & dev communities
- Responsive support and training
- NIH/NSF/etc supported dev team

Reproducibility claim in Galaxy

- Tool Shed - VCS for Galaxy tools
- Integrated into Galaxy admin panel
- Tool/deps/jobs all version controlled
- Same revision/deps when redo old
- Latest default for new jobs
- Unaffected by system binary updates

For scientists

- Ugly technical complexities hidden
- Tools and methods evolving rapidly
- Version controlled tools and deps
- Best of breed tools – uniform UI
- Complex, repeatable workflows
- Sharable data, analyses and results

For tool developers

- Easy to package up new tools
- Self installing VCS repositories
- As repositories in Tool Sheds
- Easy way to make your work available

For Everyone

- Growing, supportive community
- Responsive support mailing lists
- wiki.galaxyproject.org for help
- Active developer community
- Tool sheds ← 100s of contributions
- Growing community source patches

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Reproducible analysis for all

- Efficient X of bioinformatician time
- Commodification of complex analysis
- Democratisation of reproducible analysis

Conclusion

- Welcome to the Galaxy community!
- ToolShed == App store for Galaxy
- Admin can click to install/update
- Tight tool/dependency versioning
- Enhanced reproducibility
- Enhanced sharing of tools
- (technical detail this afternoon)

VIVA LA EVOLUCIÓN

GALAXY

http://usegalaxy.org