Future Research Infrastructures

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FACULTY OF !NFORMATICS

Science is evolving…

- Globalization of scientific cooperation and competition
- Digitization and digital skills
- Increasing interdisciplinarity
- Data-driven research
- Increasing processing power
- Ubiquitous connectivity
- Miniaturization, nano-technology, genetics,
- Smart-*, machine-actionable *, autonomous systems, ...
- "Artificial Intelligence"
- Increased pace of change

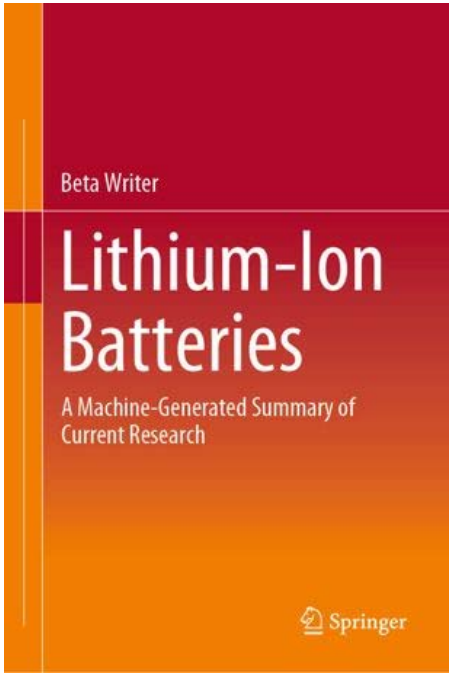
Requirements for Future Research Infrastructures

- Understanding what we might need 10-15 years from now
  - Think back 20-30 years (increased pace of change)
  - Consider impact of observable trends
  - A bit of Science Fiction (but with a focus on science)
  - Remaining just shy of the singularity predicted for 2050
- How will we / our PhD students do research?
- Who will we / they be working with?
- In what kind of environment will we / they work?
- What should we do to start preparing for it now?
- Focus on technology, infrastructure, but also legal aspects, societal, …
- Everything beyond "more of the same"

Just as an example…

- https://link.springer.com/book/10.1007/978-3-030-16800-1

- doi.org/10.1007/978-3-030-16800-1
- **Authors and affiliations:**
  Beta Writer



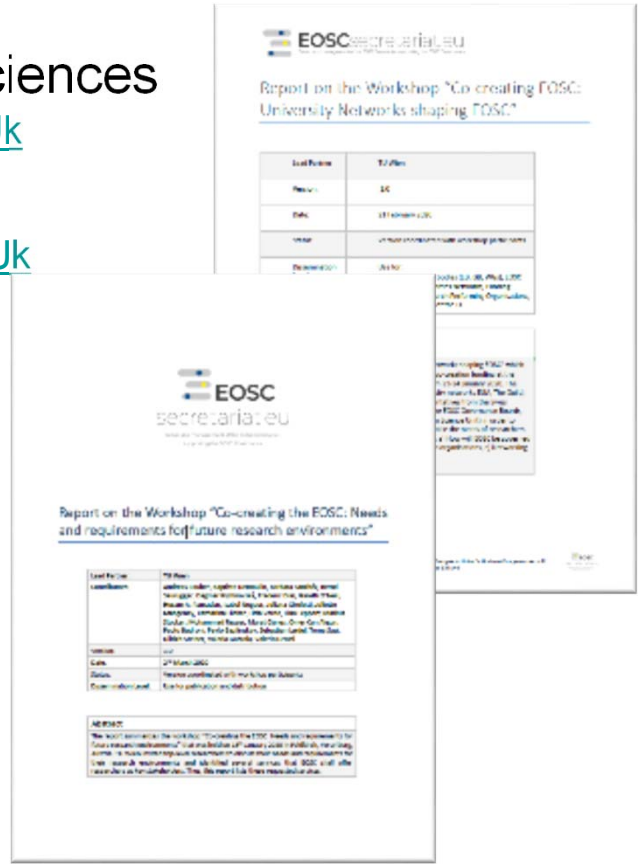
EOSC Workshop Series

- EOSC as one example of future research environments
- By-invitation-only workshops 25-35 participants
- Programme / Setup
  - What will we need?
  - 2 to 3 breakout sessions with 3 groups of around 5-10 people
  - Reporting-back sessions after each breakout session
  - Plenary: consolidation and feedback processes
  - Final wrap up
- Follow-Up Actions
  - Reports
  - Takeaway messages

Results

Reports on the workshop with:

- Researchers: natural and technical sciences
  https://zenodo.org/record/3701194#.XmY_1KhKiUk
- Members of university networks
  https://zenodo.org/record/3693914#.XmZMYahKiUk



Key take-away messages:
https://zenodo.org/record/3701269#.XmZKrqhKiUk

- Members of university networks
- Researchers: natural and technical sciences
- Science Europe

We need more…

- Only have starting points so far
  - Strongly influenced by current problems
  - Strongly influenced by what seems feasible
  - Focus on immediate next steps
  - Assuming a rather standard scientific process
- Need to think further ahead to reveal what we might need
- In spite of increasing speeds: infrastructure set-up takes time
- Need to start preparing now
  - How do we get there?
  - What services (beyond the obvious) do we need?
  - How to balance technical feasibility and future needs?

Observations from today

- Matthias:
  - *Keep the waste basket:* “publishing” raw data
  - *Smart knowledge extraction*: Tools exist, but need tuning, paramters
  - *Bring code to data (data volume, privacy)*: Federated ML, Migrating code
  - *Complete characterization*: Provenance extraction/monitoring
  - Practical AI specialists: hmm…
- Andre:
  - *Don’t share the data: bring research to data*: Federated ML, Data shielding, Cryptographic Databases
  - *Data governance*: social contracts, consent, trust, …?
  - *Reproducibility, distributed validation*: structure + semantics!?

Observations from today

- Arturo:
  - *Scientific data collections of specimens (objects):* what can / cannot be digitally represented?
  - *Importance of old legacy data*: limits of automation
  - *Bias in data*: how to represent, allow machines to understand?
  - *Complexity of data*: how to represent?
  - *Extraction, Representation, Infrastructure*: what do we need in each of these areas?
  - 7 big questions