Writing and presenting technical content

CS-E4000 ▪ Seminar in Computer Science: Internet, Data and Things

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Summary of the last week

Lecture 1

- introduction and practicalities
  - learning outcomes of the course
  - organization and assessment methods
- course topics
  - overview and tutor introduction

Course sign-up

- registration in Oodi
- request for seminar topics

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Learning outcomes

- Find research papers and technical documentation
- Describe the elements and the structure
  of a technical document
- Evaluate the contribution of a scientific work
- Outline strengths and weaknesses of a technical document
- Explain a topic in a technical format
- Present technical content as a written document
  and through an oral presentation

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Technical documentation

Technical document

- describes the functions and the architecture
- or else a study or an evaluation
- of a practical, scientific or technological product

Manual

- collection of instructions
- usually to operate a machine or software

Software documentation

- usually embedded in the source code
  - as either comments or docstrings
- documentation generators collect and convert
  the annotated source into a document (e.g., Doxygen, Sphinx)

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Types of technical documents

Specification

- detailed description of a product (e.g., protocol or algorithm) or statement of requirements
  - patent specification, description of an invention

Standard

- a technical specification subject to a codified process
- involving a standardization body (or institute)

Academic (scholarly) paper

- description of original research results or review of existing ones

Technical report

- may not include research results, usually not peer reviewed
  - whitepaper, overview of a problem and solution (content marketing)

Standardization bodies

Body	Representative fields	Examples
ANSI	programming languages	C99
IEEE	communication protocols and technologies	IEEE 802.11n, IEEE 802.15.1
IETF	Internet standards	RFC 6455, RFC 3561, RFC 3748, RFC 6238
ISO/IEC	programming languages, character sets, document formats	C++11, ISO 8859-1, OpenDocument
NIST	cryptographic functions	AES, SHA

Acronyms: American National Standards Institute (ANSI), International Electrotechnical Commission (IEC), Institute of Electrical and Electronics Engineers (IEEE), Internet Engineering Task Force (IETF), International Standard Organization (ISO), National Institute of Standards and Technology (NIST)

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Types of academic papers

Regular paper (article)
- presents original research results

Survey
- overviews (summarizes) existing research

Position paper
- expresses an opinion or vision of the future

Poster
- a large document for both information and presentation purposes

Extended abstract
- short technical report describing a work-in progress or a demo

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Publishing media

Self-publishing and document repositories

- personal homepage or research group website
- official university document repositories
  - Aaltodoc publication archive (theses, research material)
- other document repositories and archives
  - arXiv, a repository of (electronic) technical reports

Events with proceedings

- include an oral presentation of the published results
- conferences, workshops and symposia

Press

- publishing only
- journals and magazines

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Resources related to publications

Physical resources

- Aalto University library
  (`https://www.aalto.fi/en/learning-centre`)
- University of Helsinki library (`https://www.helsinki.fi/en/helsinki-university-library`)

Online resources

- Digital Object Identifier (DOI)
- publishers' websites (e.g., IEEE, ACM, Elsevier, Springer)
  - usually require a (paid) subscription
  - can be accessed from within the university network
    or elsewhere through the Aalto libproxy server
    (`http://libproxy.aalto.fi`)
- special purpose databases
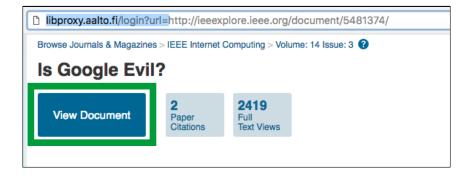 - through the Aalto-Primo portal (`https://primo.aalto.fi/`)

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Accessing publishers' sites from outside Aalto

Through the libproxy server

- add `http://libproxy.aalto.fi/login?url=`
  at the beginning of the URL
- then login with your Aalto account if needed

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Structure of an article: summary and metadata

Element	Description
Title	Very important, different media may have specific constraints or preferences; may include a short name of the proposed solution for "marketing" purposes
Authors	Order usually matters, one corresponding author
Abstract	Summary with focus on novelty and contributions; extremely important as audience decides to read the article further based on it
Keywords	For indexing purposes
Acknowledgments	Thanks to non-authors and funding agencies
References	List of cited articles, books, websites and so on

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Structure of an article: technical content

Element	Description
Introduction	Immediately follows the abstract and keywords; briefly describes the reference scenario (problem), provides the motivation and the main contributions (including relevance and significance) of the work
Related work	Usually after the introduction or just before the conclusion; overviews the relevant literature and contrasts it with the proposed solution (results)
Background	Preliminary material for the reader to understand the technical content (e.g., overview of a technology for a study about the related performance)

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Structure of an article: technical content

Element	Description
Technical content	The main part of the article, eventually consisting of multiple sections, for instance: ■ description of solution (e.g., protocol, algorithm or system), mathematical analysis, simulation (or experimental) setup, obtained results and related comments; ■ architecture, components, implementation details, qualitative or quantitative evaluation
Conclusion	The last technical section before acknowledgments and references; summarizes the article with focus on findings, also usually provides directions for future work

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Sample article: summary and metadata

RaSMaLai: A Randomized Switching Algorithm for Maximizing Lifetime in Tree-based Wireless Sensor Networks

Sk Kajal Arefin Imon*, Adnan Khan*, Mario Di Francesco†*, and Sajal K. Das*

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Abstract—In most wireless sensor network (WSN) applications, data are typically gathered by the sensor nodes and reported to a data collection point, called the sink. In order to support such data collection, a tree structure rooted at the sink is usually defined. Based on different aspects, including the actual WSN topology and the available energy budget, the energy consumption of nodes belonging to different paths in the data collection tree may vary significantly. This affects the overall network lifetime, defined in terms of when the first node in the network runs out of energy. In this paper, we address the problem of lifetime maximization of WSNs in the context of data collection trees. In particular, we propose a novel and efficient algorithm, called Randomized Switching for Maximizing
explicitly attempt to organize the network topology in such a way that sensor nodes have uniform loads in terms of data forwarding. Since nodes closer to the sink have higher traffic to forward, they run out of their energy earlier. Thus, load balancing approaches are suitable to address the lifetime maximization problem [5, 6] by creating a *balanced* data collection tree. However, existing approaches in this domain often encounter three major challenges: a) oscillation, a situation where topology changes repeatedly, while trying to balance the loads; b) high time complexity; c) unsuitability for distributed implementation. In this paper, we propose a novel randomized

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Evaluation criteria

Intrinsic properties

- clarity of presentation
- technically sound and complete content
- contribution (e.g., value)
- correct (convincing) argumentations

Comparison with the state of the art

- novelty
- significance
- requires to be aware of the relevant prior work

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Peer review: basics

Rationale

- repeatability and verifiability of the obtained results
  is necessary to establish their validity
- also part of the scientific method
- evaluation by peers, experts in the same field of work

Expected outcomes

- indication of quality and value
- selection of relevant works
- fair content-driven process (e.g., blind review)

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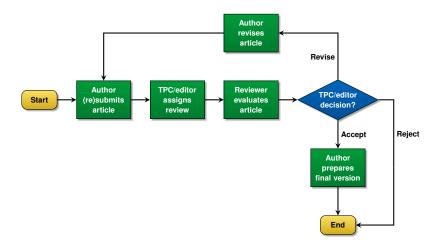# Peer review: actors and roles

Author

- writes a research article

Reviewer

- evaluates one or more research articles

Technical committee

- hierarchical structure, varies between conferences and journals
  - technical program committee chairs and members in conferences
  - editor-in-chief with area (or guest) editors in journals and magazines
- manages the peer review process
- decides accepted (rejected) papers

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Peer review: process

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Peer review: evaluation form

Example taken from a real conference

summary
: a short summary of the paper, including its main contributions and its relevance to the conference

strengths
: a clear description of the value and the nature of the contributions

weaknesses
: a clear indication of the perceived limitations of the paper, especially technical errors, missing related work and non-original results

comments
: further motivation of strong and weak points including remarks on novelty, technical depth and presentation

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Authoritative sources

How reliable is a certain source?

- anonymous sources are usually not reliable
  - e.g., Wikipedia, Internet forums, newsgroups
- authoritative source (either person or information)
  - able to be trusted as accurate or true
- standards are authoritative (by definition)
- peer-reviewed articles are usually reliable
- different publication targets have varying levels or reputation

How to measure "reputation"?

- qualitative metrics
- quantitative metrics (e.g., bibliometrics)

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Evaluating scientists

Qualitative metrics

- awards (e.g., honors, medals, prizes)
- international recognition
  - participation in important focused events (e.g., conferences)
  - invited (keynote) speaker
  - appearing in the news

Quantitative metrics

- total number of citations, usually excluding self-citations
- Hirsch index (h-index)
  - a scientist has index h if h of his (her) n papers have at least h citations each, and the other $(n - h)$ papers have no more than h citations each

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Evaluating conferences and journals

Qualitative metrics

- most experts in the field agree on the quality
- sponsored by well-known professional associations
    - e.g., ACM (Association for Computer Machinery) and IEEE
- national and international rankings
    - e.g., Julkaisufoorumi and Excellence in Research for Australia

Quantitative metrics

- conference acceptance rate
    - below 30% is good, best conferences below 15%
- journal impact factor
    - Nature: 40.137, Science: 37.205
    - JSAC: 8.085, CSUR: 6.748, TMC: 3.822, TON: 3.376

Source: impact factors from JCR Science Edition 2016

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Understanding novelty and significance

Relation with the state-of-the-art

- new ideas are such if nobody has already thought about them
- novel solutions are pointless if they are worse than current ones
- extensive knowledge of existing literature is necessary

Exploring related works

- overviews are a good starting point
  - surveys, tutorials, magazine articles
- books are also useful depending on their scope
- build on influential (important) articles
  - find them in the most focused media and communities
  - find articles citing them (e.g., through Google Scholar)

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Selected resources in computing and networking

Type	Resources
Overviews	ACM Computing Surveys (CSUR), IEEE Communications Surveys and Tutorials
Magazines	Communications of the ACM, IEEE Communications Magazine, IEEE Network
Top-tier journals	IEEE Journal on Selected Areas in Communications (JSAC), IEEE/ACM Transactions on Networking (TON), IEEE Transactions on Mobile Computing (TMC)
Other journals	Pervasive and Mobile Computing, Ad Hoc Networks, Computer Networks, Computer Communications, Wireless Networks, Performance Evaluation
Conferences	ACM SIGCOMM, IEEE INFOCOM, USENIX NSDI, ACM MobiCom, ACM UbiComp, ACM MobiSys, ACM SenSys

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A good seminar paper

Makes a contribution

- to either technical or scientific knowledge
- original work and results
- correct English with neutral (objective) style

Is informative

- a reader unfamiliar with the topic learns something
- has figures (diagrams) and illustrative examples

Has focus and structure

- covers a broad area extensively or a smaller area in depth
- provides relevant and up-to-date references
  to high-quality technical sources
- well-organized technical content

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Common issues in writing

Aspects reducing clarity

- insufficient text structure
    - linking words and paragraphs according to a line of thought
- relationships between portions of text are not adequate
- unnecessarily verbose discussion

English-related issues

- mistakes involving grammar and spelling
    - incorrect use of (in)definite article
    - verbal forms not matching subject
    - misspelled words
- word choice
    - false friends
    - correct but awkward terms

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Some advice on technical writing

General recommendations

- pronouns
    - try to avoid passive form
    - technical documents mostly use "we" when emphasizing contribution
    - impersonal form can be used: "this paper"
- avoid informal text
    - shortened verbal forms: can't, isn't, aren't, it's
    - colloquial terms: a lot, like, want, huge
- be specific: do not use "good" and "bad"

More specific instructions

- online resources (available in MyCourses under "Material")
    - Aalto Language Center's website about academic writing in English

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A good presentation

Is memorable

- key ideas should stick to the audience
- enough information to support (encourage) reading the paper
- highlights the contributions

Is structured

- logical and easy to follow
- each slide should be self-contained

Has compelling visual elements

- plenty of pictures, tables, plots, diagrams
  - "a picture is worth a thousand words"
  - preferably your own otherwise should acknowledge the source
- readable slides when projected
- consistent styling

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Some advice on the presentation

Structure

- start by introducing the topic
- then give a very short outline of the talk
  - what will be the presentation about
  - motivation: why is your work important?
- main content
  - focus on what is useful for the audience
  - do not repeat the whole content of the paper
  - make choices based on consistency and timing
- end with summary and (or) conclusion
  - what the audience should remember

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Additional recommendations

- be concise: avoid boilerplates and a large amount of text
  - the more text, the more distraction for the audience
  - the font size may be too small to be readable
- take advantage of visual elements
  - use (a limited amount) of animations to better explain
  - use color and strategic line breaking to highlight
- be confident and maintain the audience's attention
  - keep eye contact, do not read from slides
  - practice presenting and be adaptive to the remaining time

More specific instructions

- online resources (available in MyCourses under "Material")
  - Arnaud Legaut's "How to give a good talk?"

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Requirements

Seminar paper

- format
  - use the LaTeX template available in MyCourses
  - single-column layout
- submissions
  - as a PDF document
  - submit only a single uncompressed file

Slides

- no particular template required
- submission
  - only in PDF, PowerPoint or HTML
  - if you have two or more files then
    compress and submit them as a single (zip or gzip/bzip) archive

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Content of the seminar paper

First draft

- logical outline and clear message
- description of topic and challenges with key references
- two pages of readable English text

Second draft

- most of the text and the main ideas, almost final structure
- relevant, authoritative and up-to-date references
- 6–10 pages including figures, tables and references

Final paper

- complete technical content and improved outline
- polished presentation and comprehensive bibliography
- 10–12 pages excluding bibliography (up to 2 extra pages for that)

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Summary and agenda

Today's lecture

- scientific literature
  - **–** access to resources and publications
  - **–** evaluating their relevance and quality
- scientific articles
  - **–** ideas and contributions
  - **–** structure and content
- presenting technical content

Next contact session(s)

- First QA Session
- seminar day
- those of the LC-1310 course for students
  participating in the integrated English support module

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Further study

Suggested activities

- read the references you already have about your topic
  then analyze their structure and content
- explore conferences and journals related to the area of your topic
- review the additional resources of the course

Curriculum development

- Special Assignment in Computer Science (CS-E4003)
- Thesis Writing for Engineers (LC-1320)

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What to do next

Contact your tutor

- arrange a meeting as soon as possible
- contact information is available under "Available topics"
  in MyCourses and on the "Faculty" departmental webpage

Familiarize with the LaTeX template

- download the template and compile the sample document
- additional resources are also available
  under "Material" in MyCourses

Return the first draft by the deadline

- Thursday, February 4, 2021 at 23:59 EET

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