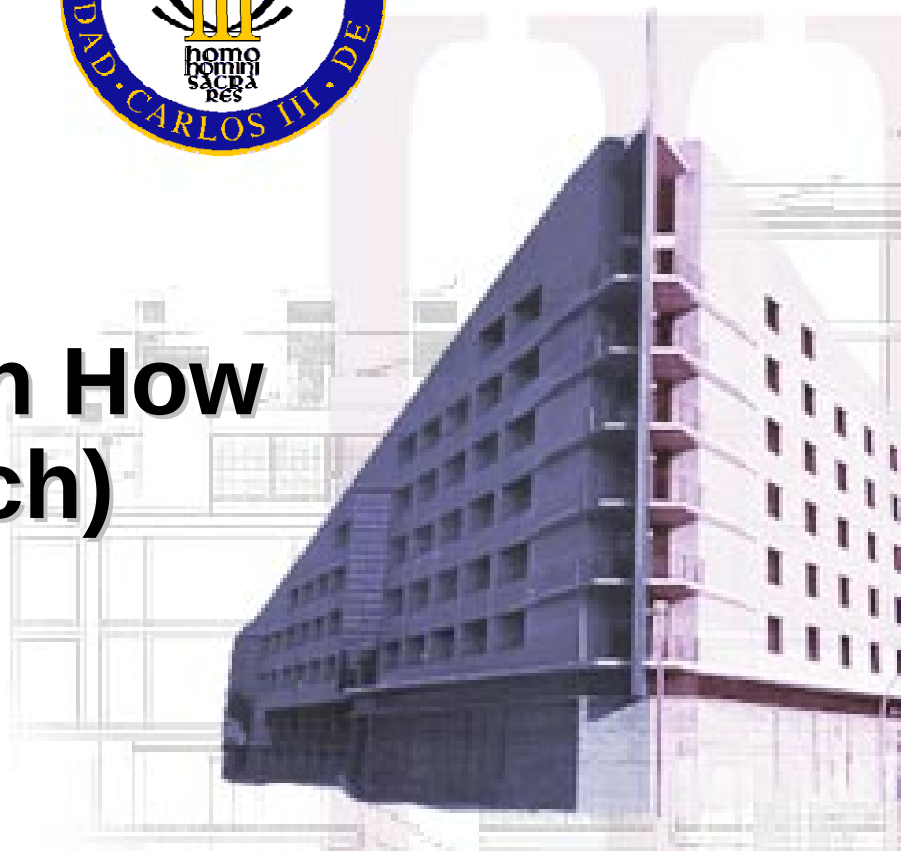
# Some Advices on How to Write (Research) Papers



# What is an *academic paper*?

(what makes it different from books, comics, IETF RFCs, commercial info…?)

- Requires NOVEL idea for a RELEVANT PROBLEM
- Results must be TECHNICALLY JUSTIFIED
  - With mathematical proves / statistical reasoning / (rigorous) logical reasoning
  - With sufficiently tested implementations
  - With simulations
- Academic papers appear in periodicals / conference proceedings
  - May be also as Technical Reports (less likely)

# Structure of an academic paper

- **Prototypical parts (structure is PREDEFINED)**
  - ***Title:*** should represent appropriately the content, and should be catchy
    - ✓ Authors: The order in which the authors appear is relevant
  - ***Abstract***: summary with a maximum number of words
    - ✓ It is usually freely accessible (even if the full paper is not)
  - ***Introduction***: justification of the problem and brief introduction to the work
  - ***Technical background required for the paper***: maybe you need to explain some theory that is seminal to your work, well-known (you don't claim to invent it), but it is needed for the reader to understand the rest
    - ✓ You may also need to present a ***model*** needed to understand the rest of the paper
  - ***Main contribution****:* here the idea is described in detail, and justified. Then proved, simulated, implemented, etc.
  - ***State of the art***: similar approaches to the one presented here, and why they are different (hopefully worse) than the one presented here
  - ***Conclusions***: highlight the main contributions of the paper
  - ***References***: in general, other papers that you cites

# WRITING academic papers

- **Be sure your paper has proper organization and structure, and proper structure of the sections**
  - ✓ **Think twice the structure of the paper after start writing!**
  - ✓ **Then, think again!**
- **Look to the particularities of the periodical/conference to which you attempt to send this**
  - ❖ **“One size doesn’t fit all”**

# Title

- Try to catch attention from the reader
  - Increases the chances that someone reads it, … cites it…
- Highlight the distinctive features of your paper, e.g., secure, reliable, scalable, high-performance, robust, low-complexity, low-cost…
- Comsoc May 2008 top ten popular articles:
  - A simple transmit diversity technique for wireless communications (JSAC Aug 1998)
    - ✓ Clear description of the paper. “simple” characterizes the work
  - A Survey on Mobile WiMAX (Communications Magazine, IEEE Dec 2007)
    - ✓ Surveys are very popular (although not “real research”)
  - Spectrum sensing in cognitive radio networks: requirements, challenges and design trade-offs (Communications Magazine, IEEE April 2008)
    - ✓ Another survey, although this time offers much detail in the structure of the paper
  - Cooperative communication in wireless networks (Communications Magazine, IEEE Oct 2004)
    - ✓ “cooperative communication” is catchy
  - A survey on wireless mesh networks (Communications Magazine, IEEE Sep 2005)
  - A survey on sensor networks (Communications Magazine, IEEE Aug 2002)
  - Performance analysis of the IEEE 802.11 distributed coordination function (JSAC Mar 2000)
    - ✓ Clear content: performance analysis
  - Cognitive radio: brain-empowered wireless communications (JSAC Feb 2005)
    - ✓ “brain-empowered” is cool
  - Cognitive radio: making software radios more personal (Personal Communications, IEEE Aug 1999)
    - ✓ Informal title to catch readers attention. Note that it is published in “Personal Communications”
  - A survey on spectrum management in cognitive radio networks (Communications Magazine, IEEE April 2008)

# Abstract

- Note that this is the only thing that many people will (ever) see of your paper
- It is the last part of the paper you should write
- Strictly limited length (see first the limits set by the editors of the publication)
  - Don’t try putting everything on it
  - Don’t go into too much detail
  - Try to be clear
- Possible structure
  - Introduce clearly the problem
  - Describe summarily your solution
  - Introduce the strongest contribution(s) of your solution

# Abstract examples

**A scalable content-addressable network.** Sylvia Ratnasamy, Paul Francis, Mark Handley, Richard Karp, Scott Schenker. *Proceedings of the 2001 conference on Applications, technologies, architectures, and protocols for computer communications.*

Hash tables - which map "keys" onto "values" - are an essential building block in modern software systems. We believe a similar functionality would be equally valuable to large distributed systems. In this paper, we introduce the concept of a Content-Addressable Network (CAN) as a distributed infrastructure that provides hash table-like functionality on Internet-like scales. The CAN is scalable, fault-tolerant and completely self-organizing, and we demonstrate its scalability, robustness and low-latency properties through simulation.

# Introduction: first sentences

- **Start with a strong statement (or a couple of them) to attract readers attention**
  - **Maybe the first sentence will take you 10 times more effort than the rest**
- **Examples:**
  - "There is a silent revolution that is reshaping the Internet. The seed for this revolution was planted with the original design of statistical multiplexing through packet switching."
  - "Nowadays, wireless devices enjoy widespread use in numerous diverse applications including that of sensor networks. The exciting new field of wireless sensor networks breaks away from the traditional end-to-end communication of voice and data systems, and introduces a new form of distributed information exchange. Myriads of tiny embedded devices…"
  - "Networks have become part of the critical infrastructure of our businesses, homes and schools. This success has been both a blessing and a curse for networking researchers; their work is more relevant, but their chance of making an impact is more remote. The reduction in real-world impact of any given network innovation is because the enormous installed base of equipment and protocols, and the reluctance to experiment with production traffic, which have created an exceedingly high barrier to entry for new ideas."

# Introduction

- **The rest of the introduction may**
  - **Describe the current practice in the field considered**
    - ✓ **Not the (esoteric) proposals, but what it is being done in the industry**
    - ✓ **Maybe comment (not in detail) some proposal if your work is built upon it**
  - **Describe summarily your proposal**
    - ✓ **With concepts that can be understood at this stage**
  - **Describe what are exactly your contributions and why they are nice**
    - ✓ **This is why people should continue reading!**
  - **Paragraph to "Present the rest of the paper"**

# Introduction: present the rest of the paper

- **Last paragraph of the introduction**
  - **You present the STRUCTURE of the paper**
  - **For me is very important: if you cannot make this paragraph *flow*, then the structure is not appropriate**
    - ✓ **Although some papers do not include this part!**
- **Eg. (from SIGCOMM 2007):**
  - We first review related work in *§*2 and then define and discuss dispute wheels in *§*3. The precedence metric is described next and its ability to prevent dispute wheels proven in *§*4. *§*5 and 6 describe how this theoretical result can be put into practice. We evaluate the resulting algorithm in *§*7 and discuss several issues in *§*8 before concluding in *§*9.

# Main contribution

- Try to make clear the main ideas
  - Maybe, you can start with an example
  - Then describe in a generic way your contribution
  - Sometimes, even finish with a “walk-around”, i.e. a particular case in which your system is exercised
    - ✓ For example, what happens in a forwarding system when A sends a packet to B
- Details too obscure can be included in an Appendix (i.e. a proof)

# Main contribution

- **If you present simulations or test scenarios**
  - **Try to describe the simulation/scenario so that could be repeated by the reader**
    - ✓ **However, don't devote a page to your simulation environment (unless the conference is on simulation)**
- **Can you show your results graphically?**
  - **Or with tables?**
  - **Avoid making comments evident from the data (graphics or tables)**

| AS | Backbone | Access | Total |
|---|---|---|---|
| Telstra (1221) | 64.4% | 78.1% | 48.6% |
| Sprint (1239) | 90.1% | 35.0% | 61.3% |
| Ebone (1755) | 78.8% | 55.1% | 65.2% |
| Verio (2914) | 75.1% | 60.6% | 57.5% |
| Tiscali (3257) | 89.1% | n/a | 41.5% |
| Level3 (3356) | 78.6% | 77.4% | 55.6% |
| Exodus (3967) | 95.4% | 59.8% | 53.6% |
| VSNL (4755) | n/a | n/a | 48.4% |
| Abovenet (6461) | 83.6% | n/a | 76.0% |
| AT&T (7018) | 65.4% | 91.6% | 78.9% |

**Table 2: Estimate of Rocketfuel's coverage of router-like named IP addresses. Aliases of known routers are not counted. "n/a" implies that the ISP's naming convention doesn't differentiate between backbone and access routers.**

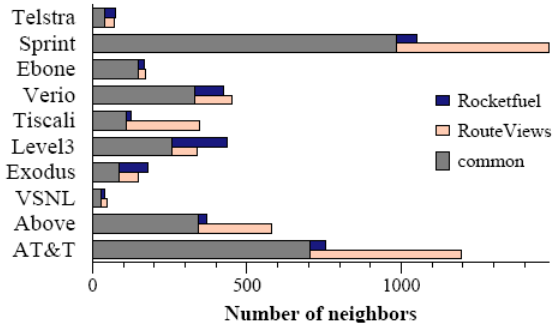



**Figure 9: Comparison between BGP adjacencies seen in our maps and those seen in the BGP tables from RouteViews.**

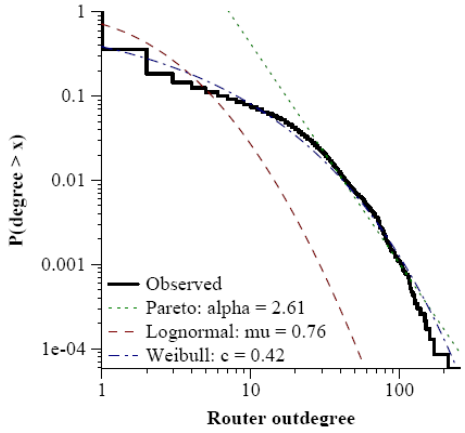



**Figure 16: Router outdegree ccdf. The Pareto fit is only applied to the tail.**

# State of the Art

- **State of the art: exhaustive analysis of the previous work in the area addressed**
  - **Different places to put this section**
    - ✓ **After the introduction if related work is seminal to your work**
      - Or if you use some proposals to compare them experimentally…
    - ✓ **Before the conclusion if the related work is alternative to your work**
      - In this place, explain why your proposal is better than each one of the alternative works referenced
      - In general, put before the conclusion if you can: avoid state of the art becoming an obstacle for the reader to reach to your idea
  - **Try to be exhaustive**
    - ✓ **If a reviewer sees that some relevant work is missing, and it is similar to yours… *you are out***
  - **Structure of the section:**
    - ✓ **One paragraph per "idea" (may be one reference, or many references)**
    - ✓ **The paragraph describes summarily the work referred, trying to detail specially the parts in which it is "similar" to yours, or it is seminal to yours**
    - ✓ **It usually finishes with justification why**
      - Your proposal is better or
      - It is so different that they do not "compete"
    - ✓ **Be accurate: the cited people can read,… and can even be selected as reviewers (because they know about the topic): don't "overactuate"**

# State of the art

- **Where to find the state of the art?**
  - **Generally, papers (although could be projects, free or commercial software…)**
    - ✓ **Look in references for other papers related with the topic**
  - **Search in**
    - ✓ **Generic search engines (not specific search)**
    - ✓ **Search engines specific for technical papers**
      - SCI (Science Citation Index), Web of Knowledge isiknowledge.com/
      - scholar.google.com
      - Citeseer http://citeseer.ist.psu.edu/
    - ✓ **Search by**
      - Key words
      - Articles that cite an article you consider relevant
- **Ideally, you should have done this PREVIOUSLY to ever thinking in writing the paper**
  - **It is however recommended to do again when the paper is ready, to identify new references**

# State of the art in “interdomain routing”

Look first on key sources, then look for any other source

- Key periodicals:
  - ACM Computer Communications Review
  - IEEE/ACM Transactions on Networking
  - IEEE Network
  - IEEE Journal on Selected Areas in Communications
  - …
- Key conferences
  - ACM SIGCOM
  - IEEE INFOCOM
  - HotNets
- Some data may appear in NANOG (North American Network Operators Group), RIPE

# Conclusions

- **Place to highlight the contributions of the paper**
  - **You can summarize your work (now you can assume the reader can understand “more”)**
    - ✓ **Try to use different sentences than those of the introduction or the abstract**
  - **It is the place to summarize the experimental results**
- **You can also include future work (optional)**
- **Remember that some readers only access to abstract, introduction and conclusions**

# References

- Inside the paper you don't need to justify everything: you reference the work of others
  - Don't claim to invent everything: reference
  - Don't copy exactly paragraphs from the referred paper: adapt and insert the reference
    - ✓ Although copied text could appear between quotes, it is not frequent
- Don't put references that are not anchored in the text
  - Unless you are writing a survey
- When you read: references can give you more papers to look for
  - Good papers are referred very often
  - Good papers in general have good references
- Note that evaluators examine the references to see if you are aware of the most relevant papers in the subject
  - They are very happy when they find their own papers ☺
  - They are suspicious when all references are from "low-quality" conferences, more than 10 years old…

# Advices for Writing papers

- **English must be correct**
  - Although note that many times writing in a foreign language is not THE problem: the problem is to write appropriately in ANY language (even in your mother tongue can be difficult)
- **Sentences must be precise**
  - Each sentence must be meaningful by its own
    - ✓ I.e. if you take out of context, it still must be true
  - Cannot be vague
    - ✓ Except for the first paragraphs of the introduction, that are used to motivate the reader
  - Statements either
    - ✓ Are absolutely evident
    - ✓ Or have been justified by other authors (in which case a reference is included)
    - ✓ Or are fully justified when they appear
- **Remove EVERY PIECE of redundant information (unless you explicitly want to stress again something).**
  - The reader may think you consider he is not smart enough
  - Avoid presenting the same idea twice in different parts of the paper: this usually means bad structure

# Advices for writing

- Don’t put more than one idea (in a broad sense) per paragraph
- Connect the sentences appropriately
  - You can use: Then, However, Therefore, On the other side, Additionally, Besides, Note that, On one hand/on the other hand, First, second, …last, …
    - ✓ If you cannot connect the sentences, maybe they should not be in the same paragraph (at least, think twice)
  - Vary your syntax.
    - ✓ Avoid “OSPF does … OSPF is… OSPF behaves…”
- Prefer present tense over future.
  - “In the next sections we study…”
- Many people suggest avoiding passive voice
- Avoid very long sentences
  - Don’t abuse either on short sentences “[4] presents a new distance vector routing protocol. Performance is bad.” <- maybe you can combine both to have a much “comfortable” sentence)
- Don’t use subsections with just one element (i.e. only 4.1.1 exists in 4.1)

# Accepting a paper: Reviewing process

- **Peer Review**
  - The editor selects a set of reviewers: typically, 2-5 reviewers per article
  - The reviewers should be experts in the topic of the paper
  - The author never knows the identity of the reviewers
    - ✓ Sometimes “blind review”: the reviewers do not know the identity of the authors of the paper
- **For a periodical, several iterations may be required (questions from the reviewers that are answered by the authors)**
- **Depending on the periodical type, different time scales for the revision**
  - Fast for letters, may be long for other periodicals

# Example of criteria for reviews

## I. RELEVANCE

**It is relevant for the publication**

## II. CONTENT

1. **Is the paper technically sound?**
2. **Are the references up to date and sufficient?**
3. **Has necessary material been omitted?**
4. **Does the originality of the paper warrant publication?**
5. **Is the work topical?**

## III. PRESENTATION

1. **Do the title and abstract summarize the paper?**
2. **Is the paper ordered logically?**
3. **Are the conclusions clear?**
4. **Can unnecessary material be removed?**

# Example of criteria for reviews

## IV. RECOMMENDATIONS

1. Having in mind the marks given above, please grade the paper in a scale of 1 (lowest) to 10 (highest)
2. Please indicate your recommendation:
   - A = Accept
   - B = Accept after minor revisions
   - C = Re-review after major revisions
   - D = Reject
3. Indicate the type of paper:
   - A = Full research paper
   - B = Research note (shorter)
   - C = Case study
   - D = Tutorial
   - E = Application note
   - F = Other (discussion, etc)

## V. CONFIDENTIAL COMMENTS TO THE GUEST EDITORS

Please give the reasons for your evaluation of this paper. Additional comments will be specially welcome in case of borderline papers (grade between 4 and 7).

****PLEASE TYPE YOUR COMMENTS HERE****