

Avoiding Multicast Acknowledgement Explosions in Multicast File Distribution Protocol

GERALD Q. MAGUIRE JR. ANDERS VÄSTBERG

maguire | vastberg@kth.se

September 4, 2020

The length of this project proposal shall not be longer than 3-5 pages (with about 400 words – 600 words describing the project) excluding title, authors, milestone chart, and appendix.

Save the document in a file with a name of the form:

author1_author2-Project_Plan-YYYYMMDD

Note: All sections must be descriptive and most will contain more than one sentence!

1 Allocation of responsibilities

List authors and allocation of responsibilities. Answer the question: Who will be involved and what are their responsibilities within the project? For example, as shown above (for the authors) and below (for their responsibilities).

Gerald Maguire is responsible for writing the test programs, writing Sections 1 and 4 (Analysis) in the report, and presenting the project plan.

Anders Västberg is responsible for collecting data using Wireshark, writing Sections 2-3, 5 in the report, and presenting the final project.

2 Organization

One or more sentences. This describes how the project is to be organized. For example:

The project will be organized as a two-person project, building upon previously published work. Once the testbed and programs are ready data collection and analysis will proceed in parallel.

3 Background

Describe the background for chosen area that is going to be investigated. Write a short description of the area that is going to be investigated. It is a brief description of the necessary background knowledge of the problem area and for carrying out the project. For example:

This project builds on the idea of multicast file distribution described in RFC1235[1]. Clients report which blocks they are missing as a vector of bits, where missing blocks are indicated by a 1 bit. The length of each block is fixed; we will assume that it is 512 bytes for this project.

4 Problem statement

Describe the problem(s) that have been found in the area described in the background. Describe the problem area (in detail). For example:

The project will investigate how to avoid so-called “acknowledgement implosion” when distributing a file using multicast. If all of the nodes that successfully receive a packet were to acknowledge it, then the sender would receive a very large number of Acknowledgements (ACKs), when in fact it is most interested in understanding which node did not receive the packet, hence to which node (or nodes) it should retransmit the packet.

5 Problem

State a clear and concise problem that is going to be investigated. Answer the question What is the real problem? - What is the problem or value proposition addressed by the project? – Ideally one sentence that is very concrete. For example:

Avoiding ACK implosion is essential to enable multicast file distribution to scale to large numbers of receivers. What techniques can we use and how should they be used.

6 Hypothesis

State a hypothesis that you think would be the outcome of your investigation. Answer the question: What is your hypothesis? (Note that the hypothesis must be measurable to be confirmed or falsified. Moreover not all projects have hypothesis.).

Avoiding ACK implosion can be performed by sending only Negative Acknowledgements (NACKs), rather than sending positive ACKs.

7 Purpose

Explain the purpose(s) of your project / investigation (the expected deliverables from the project). Answer the question: Why do this project? (purpose/effect, i.e. – the purpose can be to save environment but the goal is to build a robot that can pick up trash.) Why would you carry out the project? For example:

The purpose is to present one or more techniques that can be used with multicast file distribution to prevent an ACK implosion, thus fostering the use of multicast file distribution.

8 Goal(s)

Explain the goal(s), objective(s), and/or the result(s) of your investigation. What are the expected deliverables/outcomes from the project? For example:

An analytic model showing the advantage of using only NACKs versus positive ACKs will be derived based on fitting curves to the experimental data for both forms of multicast file distribution. This model can be used to invalidate the hypothesis.

9 Tasks

Describe the tasks and sub tasks that are necessary to complete the work. Grouped into a work breakdown structure. For example:

A simple multicast file server and a corresponding client will be implemented. A number of instances of the client will be executed with different starting times, but starting within 30 s of each other. Our test file will be a file of sufficient size to require more than 30 s to transmit when transported using User Datagram Protocol (UDP) datagrams via a 10 Mbps wired Ethernet. This file will contain a series of pseudo-random bytes. The total number of datagrams transmitted by all of the nodes will be compared when using positive ACKs and when only generating NACKs. The number of clients will vary from 1 to 1025, in increments of 8 clients.

10 Method

Describe and explain the research methods that will be used for the project. What research method (or methods) will be used? Argue: why this is the most appropriate method or methods. For example:

The project will use the empirical method[2], as it is not clear to the authors that we can use an analytical method to produce an accurate model of the protocol in the available time period for this assignment (given the available resources).

11 Milestone chart (time schedule)

Give a detailed schedule of how the project will be carried out. What is the project timeline and when will particularly meaningful points, referred to as milestones, be completed? What is the deliverable for each of these milestones? For example:

The project will start on 25 August and end at 00:00 on 30 August. There will be the following milestones and deliverables:

26 August working multicast server and client

27 August prepare testbed and perform experimental runs for each of the different numbers of clients to be completed (as per above) and stored in two comma separated files (ACK.csv and NACK.csv) which each line consisting of: number of clients, number of packets. Data will be collected using a separate computer running Wireshark. Analysis of the data and development of the analytic model will proceed in parallel with the data collection.

28 August model completed based upon using the statistical package R to do the curve fitting to the experimental data

29 August evaluation of model for additional data points to be check by new experimental runs to check that the model accurately produces the expected number of packets for the given number of clients for both ACK and NACK alternatives.

Before 30 August submit final report (the report will have been written in parallel with each of the above steps)

References

- [1] John Ioannidis and Gerald Q. Maguire Jr. “Coherent File Distribution Protocol”. In: *Internet Request for Comments* RFC 1235 (Experimental) (June 1991). ISSN: 2070-1721. URL: <http://www.rfc-editor.org/rfc/rfc1235.txt>.
- [2] Peter Bock. *Getting it right: R&D methods for science and engineering*. San Diego: Academic Press, 2001. ISBN: 978-0-12-108852-1.

A Optional appendix

In this section you can add additional information that may be relevant to your reader, but is not an answer to any of the above points. Note that the Appendix or Appendices are Optional.

The total word count is 10 excluding title, authors, milestone/schedule, references, and words in this sentence, i.e., it is a word count from “Allocation of responsibilities” to end of “Method” section.

The word count does not include the instructions and the project plan should be handed in without instructions.

B Acronyms