Preliminary Title

Preliminary Description

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Abstract

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Contents

1 Introduction

There are many paradigms of commercial sensor management and monitoring. Organizations can use anything from PLC (programmable Logic Controllers) to IoT devices to manage and monitor their sensors. For commercial use some of these alternatives are more popular than others. There are also a large amount of different higher level protocols like MQTT, HTTP and SNMP that can be used to manage and monitor sensors. We propose using the NETCONF protocol with YANG sensor models for management. This work will be done in collaboration with Lightside Instruments AS.

This document will cover the following three topics:

- **Work Methodology:** An indept analysis of the knowledge base around work methods like Scrum, Kanban, and Waterfall. With a focus on how our work methodology differs from these.

- **NETCONF and YANG sensor management**: A qualitative analysis of the NETCONF and YANG protocols and how they can be used to manage sensors.

- **NETCONF Security**: A qualitative analysis of the security aspects of the NETCONF protocol.

2 Lightside Instruments AS

Lightside Instruments is a company specializing in developing instruments with model based network management for use in networking, network interconnect testing and telemetry. They design their instruments with YANG (RFC7950) [4] models and NETCONF (RFC6241) [5] protocol. The instruments are based on IETF standards and drafts, and are implemented with software tools available in Debian, programmable logic and open hardware [10].

3 Technical background

3.1 NETCONF and YANG

NETCONF [5] is a model based Network Configuration Protocol. Each NETCONF device presents the aquiring device with a YANG [4] data model con-

sisting of the device state and parameters. Each data model has a set of constraints making them error correcting.

3.2 Node-RED

Node-RED [11] is an open source low code programming tool for event driven applications. It is developed by IBM and is based on Node.js [12]. Node-RED is used to connect hardware devices and APIs through a visual programming interface.

3.3 Grafana

Grafana [7] is an open source data visualization tool. It is used to visualize arbitrary data from different data sources.

4 Work Methodology

4.1 Research Question

This review examines the claims that Scrum, Kanban, Waterfall, Extreme Programming and DevOps increases worker productivity substantiated by empirical evidence.

4.2 Scoping Review

4.2.1 Search strategy

The following is our search strategy for the scoping review. We will be searching for quantitative studies on the efficiency of the following work methodologies:

- Scrum

- Kanban

- Waterfall

- Extreme Programming

- DevOps

We will be searching the following databases:

- IEEE Xplore [9]

- ACM Digital Library [2]

- Google Scholar [6] (Meta database)

We will also be searching the following industry websites:

- Agile Alliance [3]

- Scrum.org [8]

- DevOps Institute [13]

- Scrum Alliance [15]

Our search will consists of a set of primary and secondary keywords. The primary keywords are:

- Scrum

- Kanban

- Waterfall

- Extreme Programming

- DevOps

The secondary keywords are:

- Effectiveness

- Efficiency

- Productivity

- Performance

- Success

- Failure

The search will be done using the following search string:

```
(Scrum OR Kanban OR Waterfall OR "Extreme Programming" OR DevOps)
                              AND
(Effectiveness OR Efficiency OR Productivity OR Performance OR Success OR Failure)
```

4.2.2   Exclusion Criteria

The systematic review will include articles meeting the following criteria:
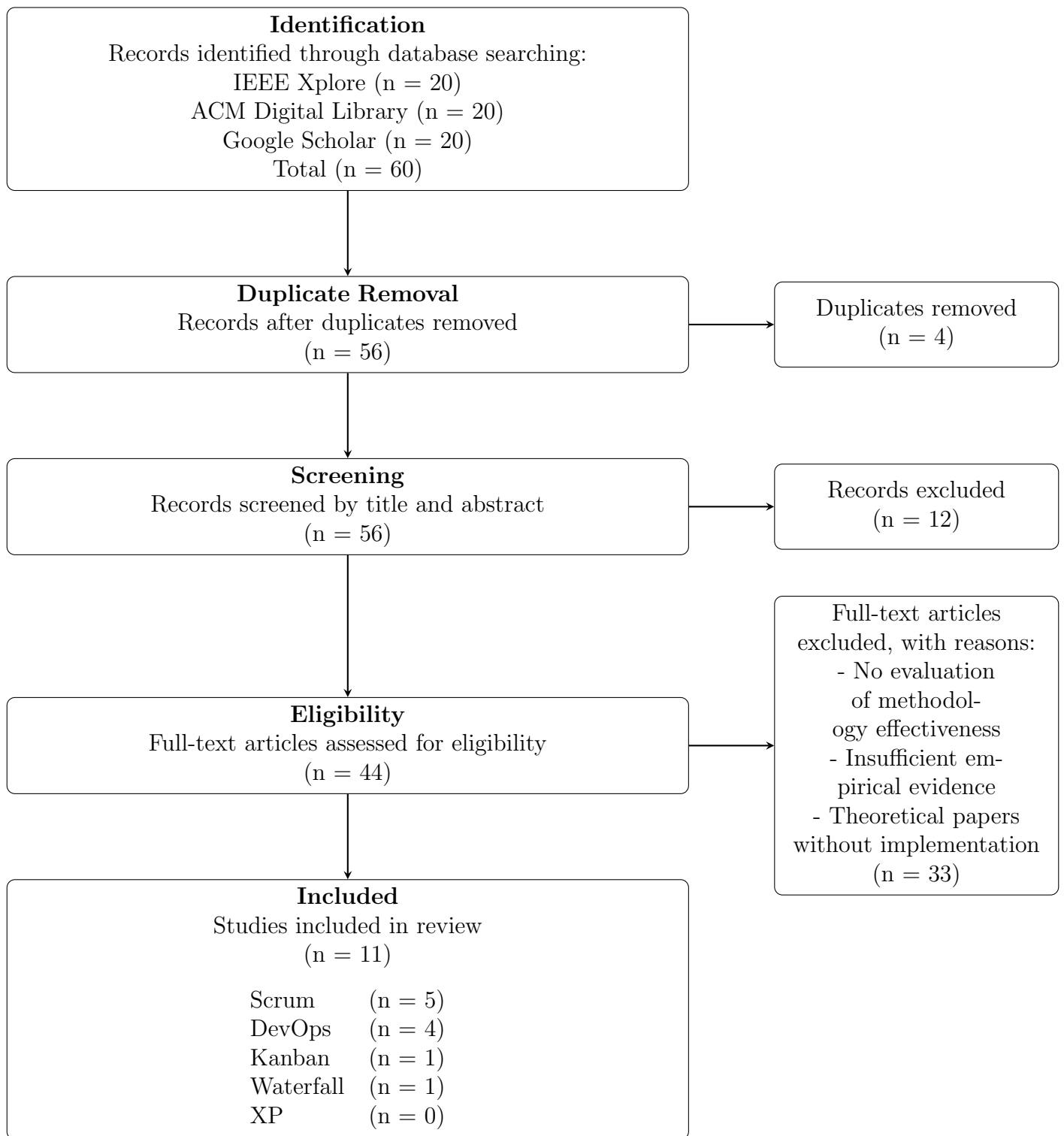
- Published after January 1, 2020

- Published in English

- Relevant to the research question

- Empirical evidence

- Quantitative studies

- One of the 20 first results from each database

- Evaluating the effectiveness of the following methodologies:

  – Scrum
  – Kanban
  – Waterfall
  – Extreme Programming
  – DevOps

4.2.3   Result

After applying the exclusion criteria to a set of 60 articles, we discovered that 4 of them were duplicates. The 56 remaining articles were screened by title and abstract, resulting in 12 articles being excluded. The 44 remaining articles were assessed for eligibility, resulting in 33 articles being excluded. The 11 remaining articles were included in the review.

4.2.3.1   PRISMA flow diagram

Figure 1 shows the PRISMA [14] flow diagram for the scoping review. The PRISMA flow diagram is a standardized way of reporting the results of a scoping review.

Identification
Records identified through database searching:
IEEE Xplore (n = 20)
ACM Digital Library (n = 20)
Google Scholar (n = 20)
Total (n = 60)

Duplicate Removal
Records after duplicates removed
(n = 56)

Duplicates removed
(n = 4)

Screening
Records screened by title and abstract
(n = 56)

Records excluded
(n = 12)

Full-text articles
excluded, with reasons:
- No evaluation
of methodol-
ogy effectiveness
- Insufficient em-
pirical evidence
- Theoretical papers
without implementation
(n = 33)

Eligibility
Full-text articles assessed for eligibility
(n = 44)

Included
Studies included in review
(n = 11)

Scrum   (n = 5)
DevOps   (n = 4)
Kanban   (n = 1)
Waterfall (n = 1)
XP   (n = 0)

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Figure 1: PRISMA flow diagram for scoping review of software development
methodologies

5 NETCONF and YANG sensor management

Sensor management is an essential part of administrating a larger network. Together with Lightside Instruments we have developed open source tools for YANG and NETCONF aimed at sensor management.

5.1 YANG Model

The YANG model is a model used to describe the state and actions of a NET-CONF device. The Internet Engineering Task Force (IETF) has developed a set of standard YANG models for NETCONF devices. For the purposes of this project we will not be using the standard YANG models, but instead we will be using a custom YANG model developed by Lightside Instruments AS that only describes the state of thermometers. See *Figure 2* for the YANG model.

```
module lsi-thermometers {
  yang-version 1.1;
  namespace "urn:lsi:params:xml:ns:yang:thermometers";
  prefix thermometers;

  organization  "Lightside Instruments AS";

  description
    "Thermometers monitoring module.";

  revision 2022-07-25 {
    description
      "Initial version.";
  }

  container thermometers {
    config false;
    list thermometer {
      key "name";
      leaf name {
        type string;
      }
      leaf value {
        description
          "Temperature in degrees Celsius multiplied by 100.";
        type int32 {
          range "-27315..max";
        }
      }
    }
  }
}
```

Figure 2: YANG model for thermometer management

5.2 Node-RED

5.2.1 Red-Netconf

Red-Netconf [1] is a Node-RED plugin that implements the following two nodes:

- **Netconf Session**: This node is used to create a NETCONF session with a NETCONF device.

- **Netconf Yangcli**: This node is used to send NETCONF commands to a NETCONF device using yangcli commands.

Using these two nodes we are able to create Node-RED flows that can manage NETCONF devices.

5.2.2 node-yuma123

5.2.2.1 easyNetconf

5.3 Grafana

6 NETCONF Security

References

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http://flows.nodered.org/node/@lightside-instruments/red-netconf.
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[5] Rob Enns et al. *Network Configuration Protocol (NETCONF).* Request for Comments RFC 6241. Internet Engineering Task Force, June 2011. DOI: `10.17487/RFC6241`. (Visited on 01/12/2025).

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[11] *Low-Code Programming for Event-Driven Applications : Node-RED.* https://nodered.org/. (Visited on 03/29/2025).

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[13] *Organisations-.* https://www.peoplecert.org/Organisations. (Visited on 03/28/2025).

[14] *PRISMA Statement.* https://www.prisma-statement.org. (Visited on 03/28/2025).

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