RSComPro: An Open Communication Protocol for Remote Sensing Systems

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RSComPro: An Open Communication Protocol for Remote Sensing Systems

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Introduction

In order to improve wind velocity measurement techniques with multiple remote sensing instruments it is advisable to centralize their coordination within a distant 'master' computer. The master computer should be able to communicate with the instruments by an exchange of data packets using any type of network, since this allows a flexible deployment of the instruments and master computer for measurement campaigns.

Having in mind a possibility to coordinate divers range of remote sensing instruments (e.g., lidars, sodars, radars, etc.), the communication between the master computer and instruments should comprise a general set of commands sent from the master computer to instruments, their responses to commands and their actions on commands. Data packets, which encapsulate the commands and responses, should be small enough to allow an uninterrupted and fast coordination of instruments even in the case of mobile networks such as GSM.

Based on all these recommendations we have developed the Remote Sensing Communication Protocol (RSComPro) for the simultaneous coordination of multiple remote sensing instruments through a UDP/IP and TCP/IP network.

RSComPro Implementation

RSComPro is an open communication protocol [1]. Hierarchically the protocol belongs to the application layer of the TCP/IP stack (Figure 1).

The protocol defines commands sent from the master computer to remote sensing instruments (Table 1 and 2), responses to commands, actions on commands, possible alarms from abnormal behavior of the remote sensing instruments, and the packet structure for each command (e.g., Table 3), response (e.g., Table 4) and alarm.

RSComPro has been already applied for the development of the long-range WindScanner, a system of three coherent pulsed Doppler scanning lidars (i.e., Windscanners) coordinated by the master computer [2]. Currently, two long-range WindScanner systems exist, and they are operated by DTU Wind Energy and ForWind. Both system comprise the same type of lidars, which have been developed jointly by Leosphere, DTU Wind Energy and IPU [3].

The protocol has been implemented in the WindScanner Client Software (WSC), which runs each WindScanner in the system [2]. Also, based on the protocol two master computer software (MCS) have been developed, one by DTU Wind Energy (Figure 2) and the another one by ForWind.

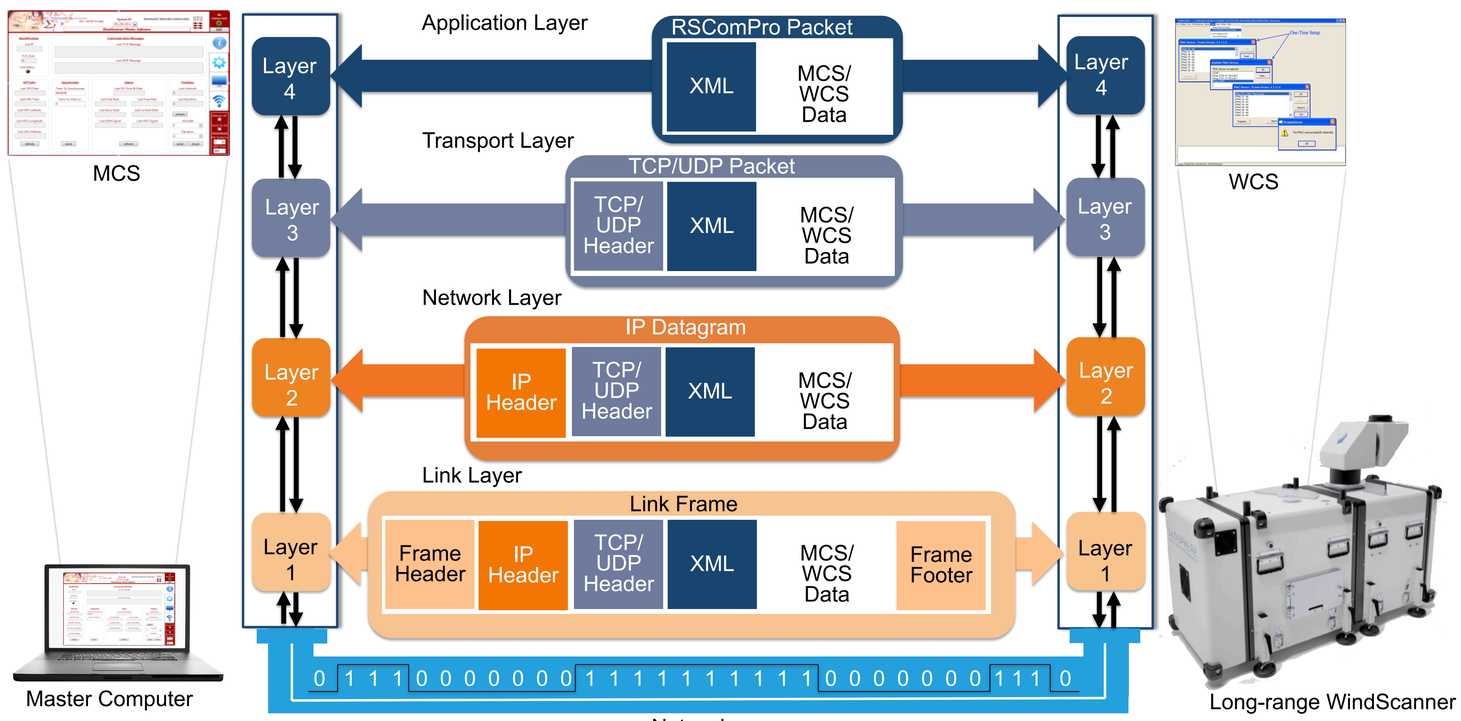

Figure 1. TCP/IP stack

Command	Code
WhoIsThere?	1100
Abort	1200
Unlock	1300
Stop	1400
GetStates	1500
IsBusy?	1600
Shutdown	1700
Reset	1800

Table 1. UDP commands

Command	Code
GoHome	2100
GetGPS	2200
GetCompass	2300
GetConfiguration	2400
GetPosition	2600
SetPosition	2700
GetScenario	2900
SetScenario	3000
Measure	3100
GetData	3200
Wipe	3300
GetCapabilities	3400

Table 2. TCP commands

```
<packet Client="Master" PckNo="0.1" Cmd="2200" Alert="0">
      <msg></msg>
</packet>
```

Table 3. RSComPro packet for the command GetGPS

```
<packet Client="Košava" PckNo="1.3" Cmd="2200" Alert="0">
      <time>124520.50</time>
      <date>141212</date>
      <lat>554137.8778N</lat>
      <long>120513.5359E</long>
      <alti>40.091042</alti>
      <msg></msg>
</packet>
```

Table 4. RSComPro packet for the response on GetGPS command

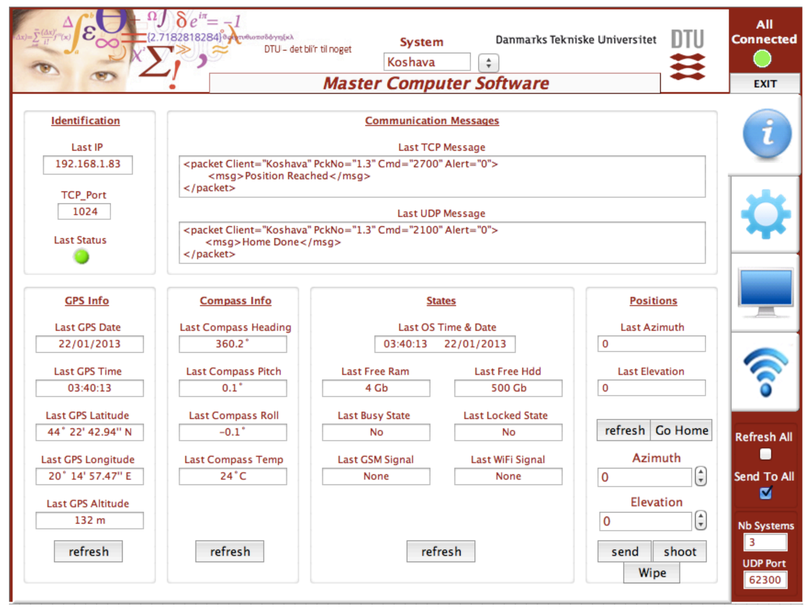

Figure 2. DTU Wind Energy's master computer software

Future Outlook

We hope that RSComPro will be widely accepted by the remote sensing community, and that other individuals, research groups and companies would join us in future developments and applications of the protocol. This would allow the coordination of different types of remote sensing instruments from a single master computer (Figure 3), and thus it would form a basis for the further advancement of our understanding of the atmospheric flows.

Reference

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[3] Bradley, S., & Mikkelsen, T. (2011). ***LIDAR remote sensing***. International Sustainable Energy Review, *5*(3, LIDARS Supplement), 2-7.

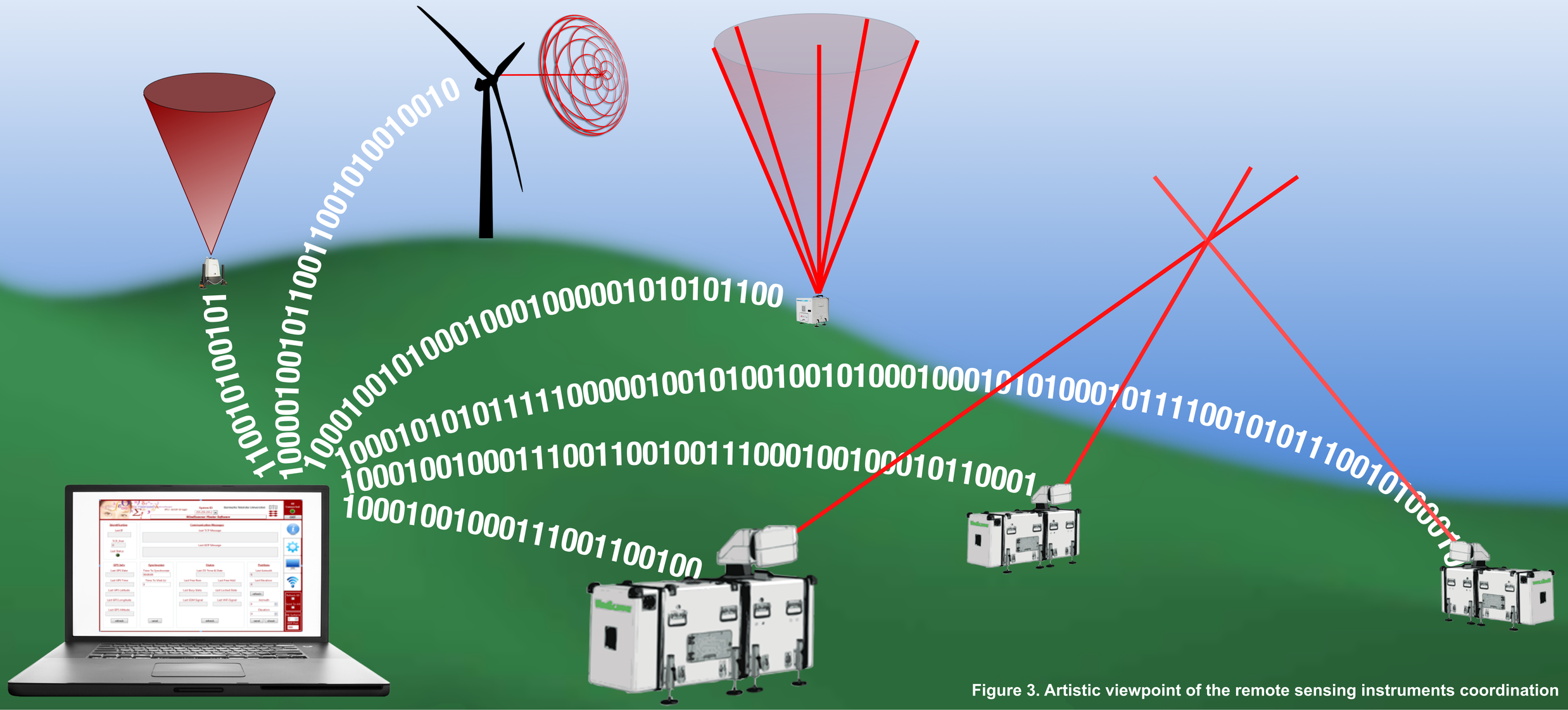

Figure 3. Artistic viewpoint of the remote sensing instruments coordination