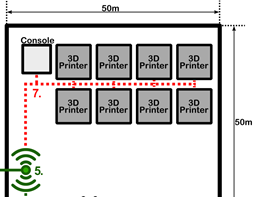
Point 7

# Problem

Point 7 manages the link of the 3D printers to the PrintMeNow business network (Connection Point 5). The network will be expected to manage initially 8 printers producing 25 models a day with the capacity for suitable expansion. The network must provide access for 2 technical staff members manning the warehouse. Below Figure.1 illustrates the 3D printers and a management console connecting via wireless router seen in point 5.

**Figure.1**



# Considerations and Assumptions

The majority of current 3D printers and technologies commonly connect via USB or Wi-Fi [1].

When extending the connection from network point 5 to the printers and staff using wired or wireless [2] technologies the printer demands on network resources, the size of network coverage in the warehouse and its accessibility need to be consider. Hardware such as a wired/wireless repeaters to filter and rebroadcast signals over long distances are usually good practice for distances in excess of 100m. As the warehouse dimensions are only 50x50m the network would not benefit from this hardware [3].

Printers on the network will occupy more network resources whilst transferring data from network to printer. The connection between the network and printer only need be maintained whilst data is transmitted. Network connection loss during transferring data to the printer can corrupt a print job which will waste time, materials and money. The average 3D print time for a model is roughly between 3 and 4 hours based on typical large model sizes of 200x200x150mm. 3D model average data sizes are determined by scale, detail, print colour and material. It is assumed that the printers will support common model print sizes such as the dimensions in the example above. The link between the network and printer needs to support reasonable download speeds and less concerned with upload speed. Much more data will need to be sent to the printers than received and once the data is uploaded printers will still be vacant for the remainder of the print job.

Network connection security is less of an issue inside the warehouse than external connections between the warehouse and business offices. Accessing the network would then be managed by controlling personnel access to the warehouse.

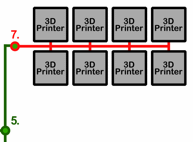
The cost of instalment, maintenance and reusability must be affordable and practical. Catering for expansion of the network and instalment of new devices.

# Potential Solutions

## Solution 1: USB Hub

Displayed in Figure.2 the installation of a USB Hub to a management console located at point 7 would allow the 3D printers to be connected physically using USB2.0/3.0 cabling to the Hub as seen in red. The management console then connects via Ethernet cat5 cabling fed from point 5 as displayed in green. The management consoles is the access point for the technical staff situated within warehouse.

**Figure.2**



### PROS

Connecting the 3D printers using USB cabling and a USB Hub would provide a more secure network.

Physical cabling is more reliable than wireless at is not susceptible to weather conditions or signal interference from obstructing materials like metal.

Wired networks offer faster data rates than wireless. They can support network speeds up to a gigabyte per second.

Hubs can be interlinked with one another to join together clusters of connected USB devices. Although there are some limitations to this method it does however provide an simple method expansion.

### CONS

USB hub will need an independent power supply (self-powered) so that the number of downstream ports is not limited to just 4. Self-powered USB are slightly more in cost than bus-powered or dynamic powered but not a substantial gap cost [4].

There would be potential hazard risks of physical cabling all over the warehouse or an extra cost to store them more practically.

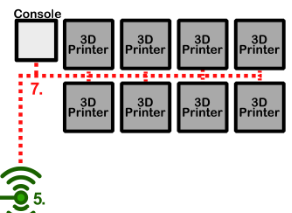
In order to achieve USB2.0 or 3.0 data rates all connections from the USB device (printer) to the computer (management console) must be of the same USB version else data rates are capped at the lowest cable version connected.

Extended the network would require another Hub, USB cabling and separate power supplies. Apart from the greater cost there is would be more hardware to maintain.

## Solution 2: Wireless Router

Installing a wireless router at point 5 of as seen in Figure.3 would provide network coverage for the entire warehouse allowing more flexibility of location when installing printers, management consoles and devices. As there is a fibre OM3 cable running directly into the warehouse security within the building is less of a concern making wireless a versatile and cheap option here.

**Figure.3**



### PROS

A wireless router provides ease of accessibilty from anywhere within the warehouse.

Relocating and connecting new devices to the network can been easier with no extra hardware.

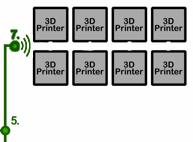
Installment is cheap, easy to manage and non-invasive around the work place. The potential of reusing network hardware if relocating business location is better than that of a physical line.

### CONS

With a wirelss router installed the wireless network types such as 802.11g or 802.11b that the router supports should match that of the printers as a difference could slow data transfer rates. [5]

## Solution 3: Wireless network Hub

This solution would have an Ethernet connection via cat5 cabling from point 5 directly to point 7 the static management console. A wireless network hub is then used to connect the Wi-Fi enabled printers to the network.



### PROS

Network is less secure as it can be accessed from anywhere in the warehouse. Security then has to be controlled by access to the building.

### CONS

Wireless networks have limited bandwidth. They are also limited to expansion due to the demand wireless spectrum [6].

# Proposed Solution

The proposed solution is a wireless setup. As seen in Figure.1 connection point 5 will host a wireless router. As mentioned early in the document a repeater is not necessary due to the dimensions of the warehouse. This option would reduce the initial cost of instalment maintenance and expanding the warehouses operations.

# References

[1] 3D Printers, RS Online. Available at: <http://uk.rs-online.com/web/c/computing-peripherals/3d-printing-scanning/3d-printers/>

[2] Wired vs Wireless. Available at: <http://smallbusiness.chron.com/explanation-wireless-vs-wired-printers-58672.html>

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[7] Ethernet over USB, Wikipedia. Available at: <https://en.wikipedia.org/wiki/Ethernet_over_USB>