## **Experiments**

Bachelor Project 2013 by Joël Gähwiler

### Introduction

I used the experiment phase to try out some technologies think more about my topic and define my final concept.

#### 1. Week

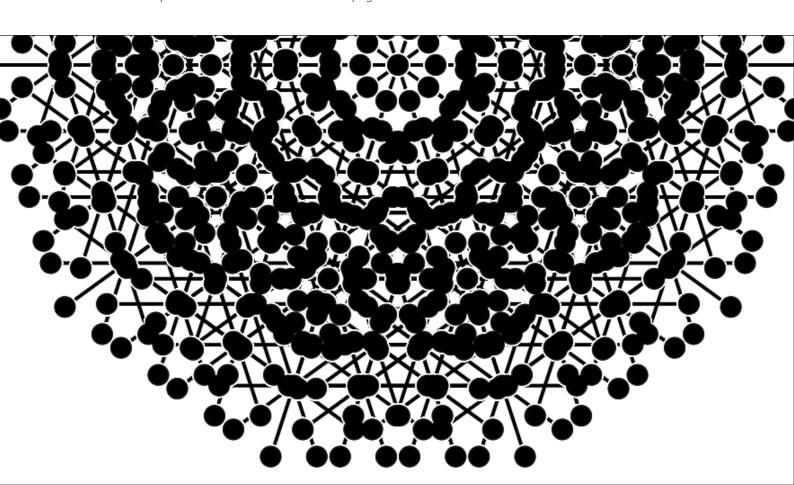
In the first week i took a deeper look into the technology i discovered in the research phase. The idea was to setup a mesh network and try out what is possible with that technology. Also i wanted to get deeper into the raspberry pi as a platform for further development.

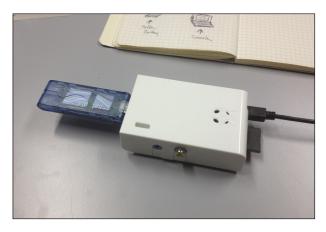
### **Mesh Networking Experiment**

The first experiment was trying to get a mesh network working with some raspberry pis and wifi dongles. For that i managed to get two Raspberry PI's, WiFi Dongles and SD cards.

For rapid prototyping the mesh network is used the airmesh distribution<sup>1</sup>. This is a standard "raspbian" distribution with all the tools installed and pre-configured. It uses the B.A.T.M.A.N router to create the mesh network over the wireless interfaces. The distribution is very straight-forward and gives a good basis for further projects.

<sup>1</sup> http://www.netlore.co.uk/airmesh/?page=about



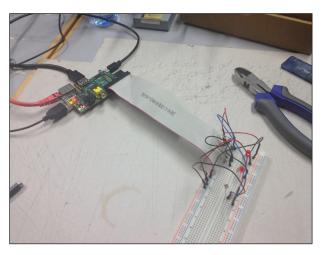


For one of the dongles i needed to install a special kernel module<sup>2</sup>. Blacklisting the old module made it persistent<sup>3</sup>. Setting-up the mesh wash not that complicated since the air mesh distribution does automatically configure everything.

The mesh network was working between two Raspberry Pl's. I managed it to connect a laptop to each node. To test how the system behaves if one of

the nodes fail, i setup a basic website on all nodes and connected computers. In several tests i powered off the nodes and the network survived every time.

As a next step i tested the ranges of the different wifi dongles in the school building. I realized very fast that an external antenna makes an huge difference in the range. I placed one Raspberry PI in the hallway of the basement. Naturally a "line of sight" connection is the best way for a connection. But with the external antenna it's also possible to leave the line of sight by 20-40m and also go outside oder downstairs/upstairs.



#### Raspberry Pi GPIO & Arduino

The Raspberry Pi comes with some basic GPIO<sup>4</sup> pins on the board, which can be used for attaching other hardware over an I2C, SPI or serial interface. After connecting a LED to one of the pins, i was able to power on/off the led through the command line or a python script.

Taking the experiment further i attached an Arduino over an serial connection to the Raspberry Pl. By sensing

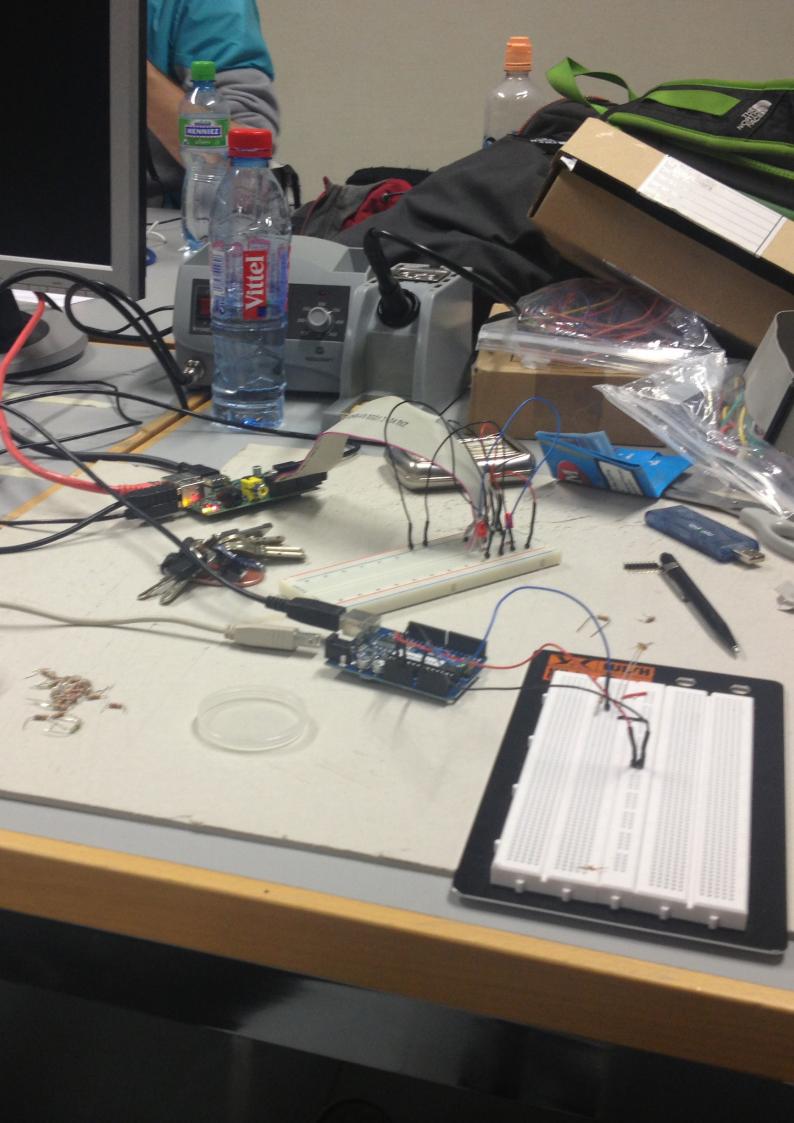
the light with a photodiode i created a script that turns the LED on when you pull a lighter in front of the diode.

I also experimented with some piezo electric sensors, to sense vibrations in the floor and triangulate the position of persons. I postponed the project due to missing materials and time for achieving that.

<sup>2</sup> https://github.com/hexameron/rtlwifi

<sup>3</sup> http://wiki.debian.org/KernelModuleBlacklisting

<sup>4</sup> http://elinux.org/RPi Low-level peripherals



### 2. Week

After this hard in technology focused week, i went back to the sketch board to drive my concept further. After many talks with the mentors and other persons i was a little bit lost in all my ideas i generated since i started with the bachelor project. To get a littler overview over everything that was floating in my mind, i created an idea map.

First i started with writing everything that interests me on pink notes. After that i put yellow direction notes onto the board. I differed between long time projects, which last longer than the actual exhibition, and short time projects. I also differed between projects for laymen, aware people and visitors. Additionally to that i added the 6 topic notes: "What is cloud computing?", "People are not aware of what they are doing in the internet.", "Dependency on state and companies for network infrastructures.", "No Control over digital data and identity.", "How feels ubiquity?" and "How do machines interact in our future life?". The green notes symbolize the possible outcome of the project.

This refocussing helped me a lot and i used it as a basis for my further thinking of the project. I also thought about how my project at the end should look like. From this perspective it was clear for me that i want to build something that the visitors can experience and explore. This thoughts i put into my next concept.





#### Nubes

Over the past years consummation and computer usage models have changed. Our society is turning away from product consummation to a richer service consummation model. Producer of goods are changing to that model by selling experiences rather than selling only the products. In the digital world this change means that producer of applications, games or other digital products stop shipping physical copies of their product, which user have to install on their computer. They serve their goods as services over the internet, we mostly can use independent from devices and physical locations. Through API's (Application Programming Interfaces) the services can be connected to machines or other services rather then only to humans. This impressive interconnection of machines, users, services, business models, countries, law models is called the cloud. The most people are using at minimum a so called cloud-service. But only a fraction of them, people with computer related background, do really know how these services and the cloud really work.

### Concept

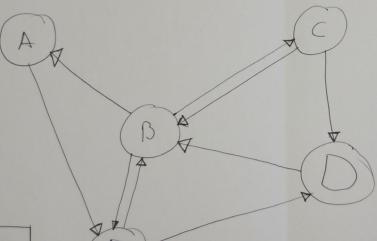
After creating the idea map i pushed myself to create a full concept for an idea that was in mind at that time. I called the project "Nubes". My goal was to create an art installation that shows the visitors how the massive cloud in the internet works and how they interact with it everyday. I wanted to give answers to the following questions:

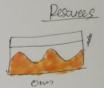
- What is it?
- How does is look like?
- How does it work?
- How will it evolve?
- Where is ist?
- Who controls it?
- How does it sound?
- Can i see it?
- Can i touch it?
- What about distances?
- How does data flow through it?
- How do participants speak to each other?
- Does it have a weight?
- Where is my data?

Since the cloud consists of different services from certain providers it is complicated for users to get a real overview. All the services are connected to each other and form a network which is comparable to the human brain.

## SERVICES

A GAME FOR EXPLORING THE SERVICE CHENTED ECONOMY

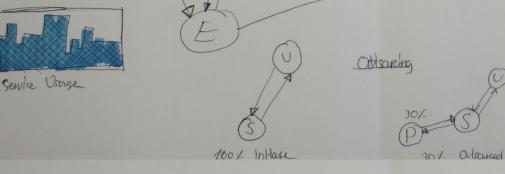






- Person form Services

- Incomming Data needs to be processed and relad to others.
- Person have tools to make then Service efficient.
- MMOG Style.
- Playable over Wifi-Ment & CSIDNS.
- Decembralized Architectura
- Internation Flow can be visualized.

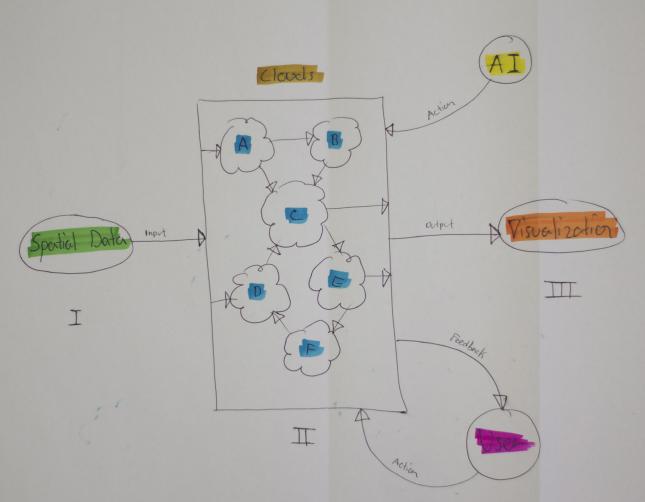








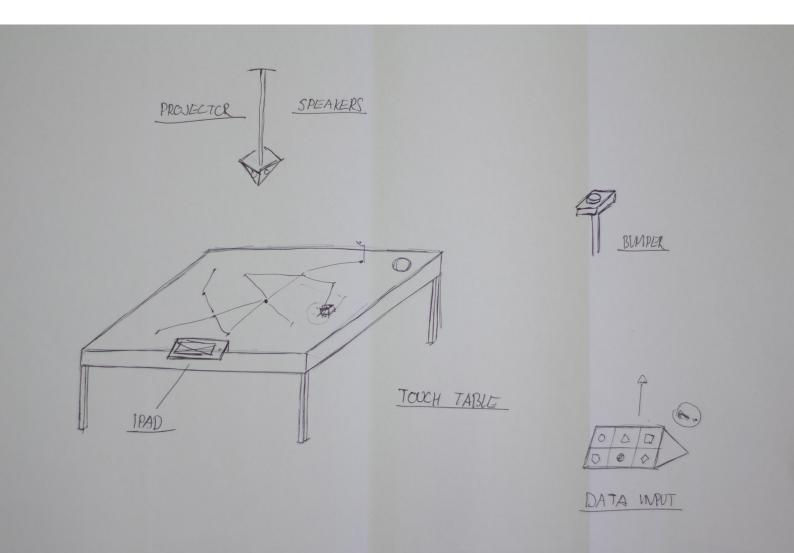


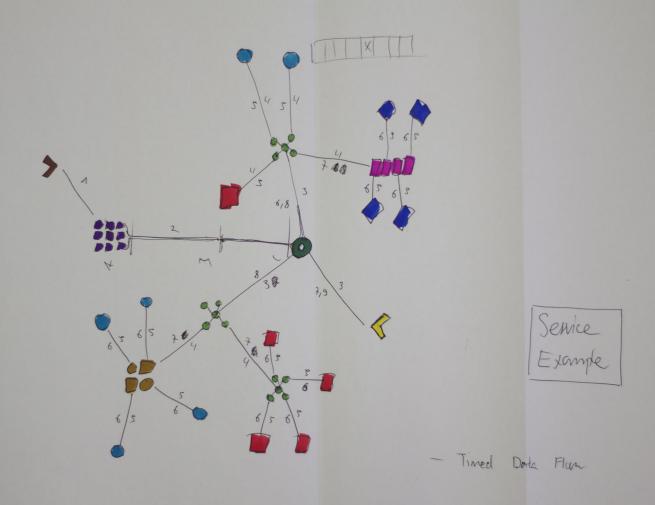


With Nubes i wanted to create a simulation of the cloud, where visitors could create services and connect them to other services to see how the cloud looks like.

The installation would consist of a centered table and 2-4 iPads attached to the lanes of the table. Visitors would be able to create services with an native iPad application. A visualization on the table would show the whole cloud and the data flowing through it. Creating services should be like playing with Lego, through connecting different building blocks together they could form an unique construct. My idea was to let flow sound through the simulation to symbolize the data in the cloud. The building blocks would then actively manipulate and change the sounds. For the input i couldn't decide between a spatial gathering of data or some kind of active generation of a stream through the users.

The concept was at this point merely rough and i decided to keep it that way, to concentrate on other questions like the visualization and how the data should flow through.





### SIMULATION CLOUD

### Resources

- Serven (Computation)
- Dortabuse (Sturge)
- Application (Calculation)

### Extensions

- Cluster (Server & Potabase (contributer)
- Stack (Application Marson)

### Infrastructure

- Router (Main Connecti)
- 35 Smitch (Spitter)

  - > Gaterray (Input Monger) Request
  - API (Output Monga) Response

## Special

Firewall (hpv Volidodon)

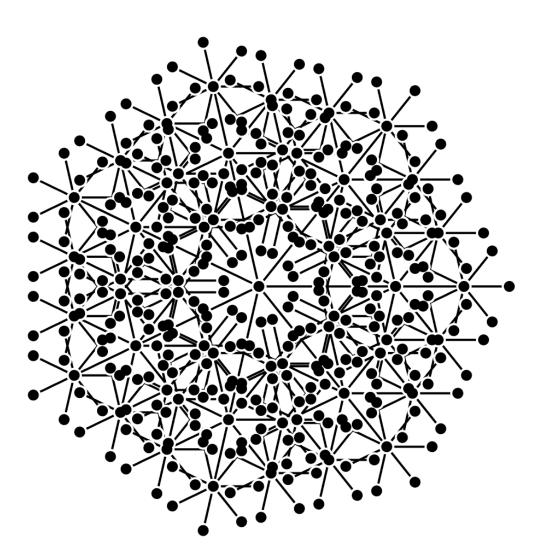
### 3. Week

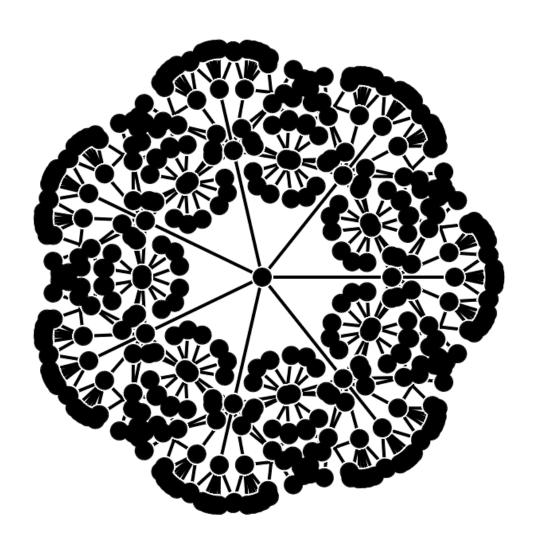
In the third week of the experiments phase i totally concentrated on visualizing networks data and generative design. I knew that my project would be computing intensive and that frameworks like processing are maybe to slow for that sort of stuff. I decided to look into a more native way of programming such things. After some searching i found openFrameworks<sup>5</sup> a C++ framework like processing for Java. Since C++ compiles into native machine code it can be used co create fast and impressive visualizations in 2D or 3D space.

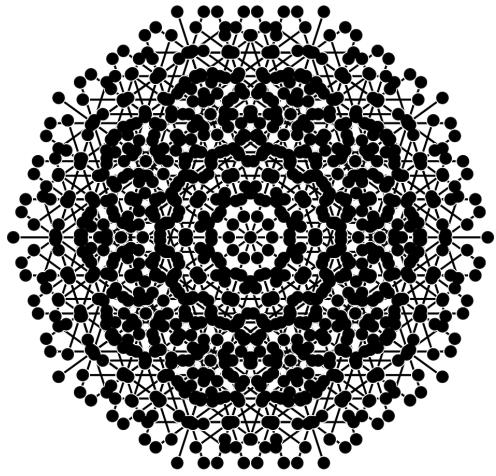
My first task was to try to visualize a network and write an algorithm that automatically balances a nodes connected to each other in way that all the nodes are visible and nicely organized on the screen.

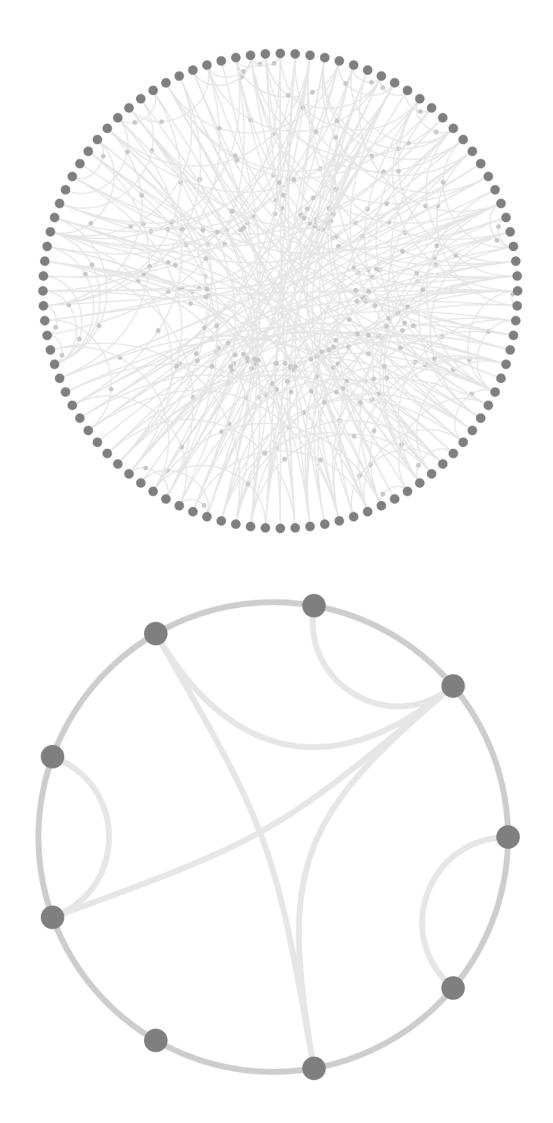
The second visualization uses another approach to visualize the interconnection between the nodes. It also shows how data flow could be visualized. For this prototype i went hard into mathematics and calculation of bezier splines and curves.

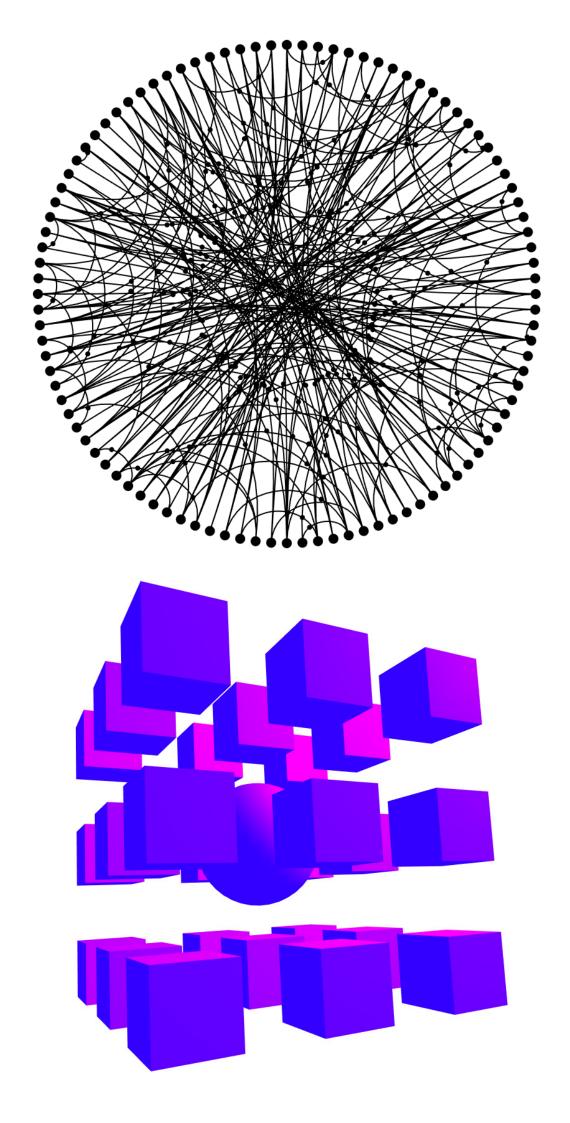
For the least prototype i tried to get into 3d space and the world of openGL, the native language to program the graphics card. Building a 3d space is complicated than i thought at the beginning and it stopped the experiment early after i didn't get the results i wanted in appropriate time.











### 4. Week

The Experimental phase is coming towards an end. After reevaluating the "Nubes" concept, i realized that it is to technology based and not that interesting for visitors than i thought before. I wanted to find something that is easier to understand and has a grater impact on the further thinking of the visitors of the exhibition.

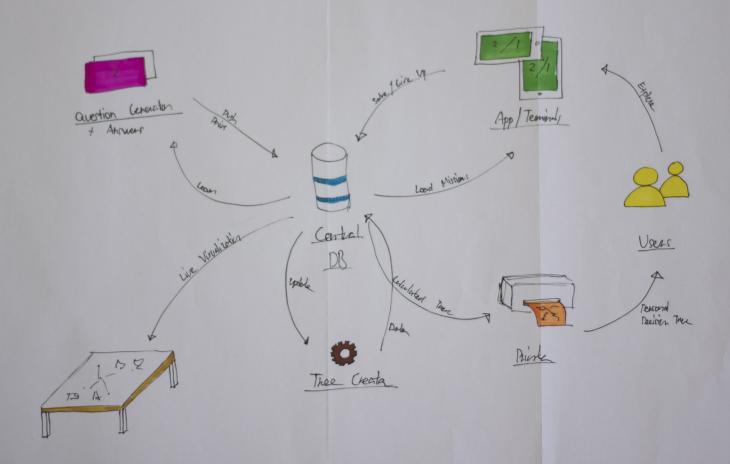
Over the last weeks i also realized that my topics are always around: "How do we interact with internet, how has it changed us since we use it?". Making a logical bridge to this topic i came up with: "The internet is information, informations i knowledge, how did this type of knowledge change us?". Digging a more deeper i found my final concept called "Ogment". The details of the concept can be found in another document.

### 5-6. Week

I spent the last two weeks on refining the final concept, redo some background research and also prototype aspects of the project. This steps can also be reviewed in the according concept document.



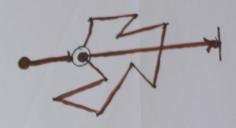
## SYSTEM MODEL



# AUGHENT

Visualizin the Iteman Enhancement of the Drain through the Intenet.

HY Viscolication



#1 Question



# 2 Calculation



#3 Answer

