

# SpringRain: An Ambient Information Display

VAST Challenge MC2 Award: Outstanding Creative Design

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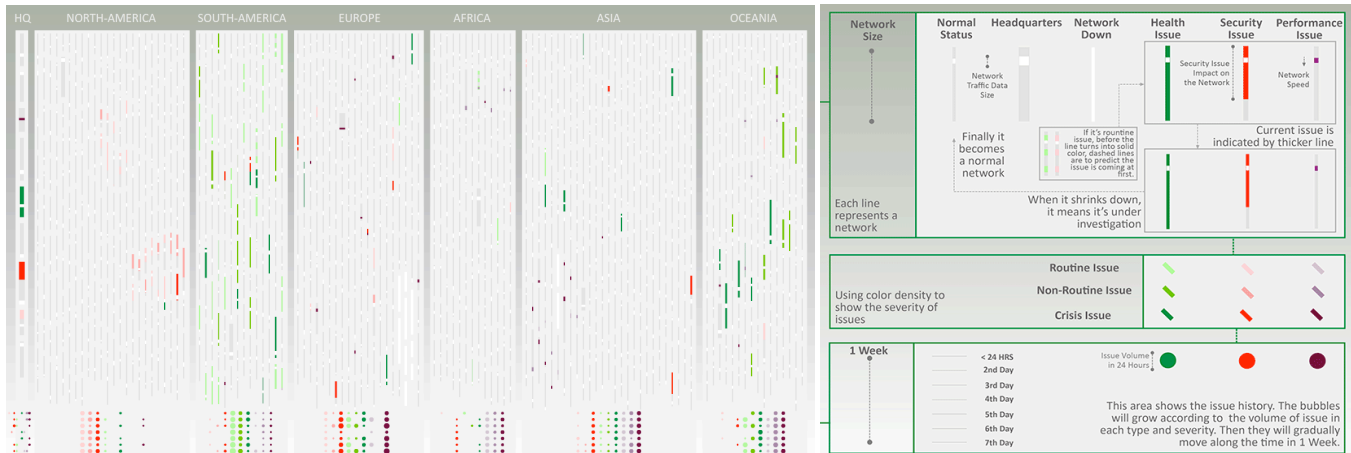


Fig.1. SpringRain displays a global computer network according to their abstracted geographical locations. To highlight reoccurring issues, the bottom tier of the screen displays a weeklong history of each issue type and severity.

Fig.2. A key to SpringRain's design elements.

## ABSTRACT

SpringRain is a visual analytics system designed to function as an ambient information display in a control room. Inspired by natural scenes it is designed to offer a cognitively light way for displaying detail-rich information. It is scalable, visually and structurally flat, and presents a real-time visualization of a large-scale computer network. It takes into account the hierarchical structure of a network and its control room environment, allowing for effective management of specialist teams via one comprehensive display. SpringRain's compatibility with Google Glasses further serves communicative efficiency: it enhances analysts' workflow and speeds up the problem-resolution process.

**Index Terms:** [Human-centered computing]: Visual analytics, information visualization, user interface design, ambient intelligence; [Networks]: Network monitoring, network management.

## 1 INTRODUCTION

To understand the set up and workflow of a computer network control room, we conducted a series of interviews with a specialist network security analyst. The findings helped us establish how control rooms function to monitor a network for certain conditions and avoid degraded service by controlling it in real-time. Given

the urgent nature of work in the control room setting, the organizational structure tends to be very hierarchical. Employees are frequently distinguished and utilized based on their expertise type and level. At the same time, management is strongly centralized and directive via formal lines of communication. As a result, a central information display should be comprehensive, easily legible, and facilitate connectivity across organization connectivity.

The task of VAST 2013 Situation Awareness Display mini challenge was to design a large visualization that would grant analysts awareness of the current condition and help them understand its effects in light of their pertinent goals [1]. Ambient Information Displays offer a cognitively light method for displaying information that does not require constant attention from the user [2]. Ambient displays seek to convey a continuous feed of live information subtly in the background, without alerting to unnecessary effect. In our search for delicately complex design we looked to nature and were inspired by the scenes of waterfalls and fresh spring rains (Fig.3). We aimed to bring the natural outdoor scenes indoors so that the display can be soothing for those who work with monotonous and detailed data on a daily basis.



Figure 1: Fresh spring rains and waterfalls inspired the information display's colors and dynamic visualization, respectively.

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## 2 THE AMBIENT VISUAL ANALYTICS DISPLAY

Apart from being inspired by nature, we acknowledged the constant dynamism of large-scale computer networks and decided to utilize this motion in our display. The normal condition is visualized as delicate gray raindrop lines, while abnormal issues emerge in their distinct colors. Apart from a tranquil representation of a global network for operations specialists to investigate and interact with, SpringRain can also function as a beautiful ambient display in the general manager's office for him/her to monitor the overall condition (Fig.1).

### 2.1 Design Principles: Scalable, Flat and Abstracted

Based on our understanding of the networks' structure, we designed the overall visualization to follow these key principles:

**Scalability:** Individual computers are aggregated into sub-networks or offices and are visualized as line segments, as a 'drops of rain'. Such line-based visualization allows our design to be scalable from thousands to tens of thousands of computer networks on different display sizes. Our illustrative prototype displays about one thousand networks (Fig.1), but we tested the design on multiple monitors showing six thousand networks as well as in a conference room via a high-resolution projector. These attempts gave satisfying visual results.

**Flat structure of information:** SpringRain is designed to present three issue dimensions: health, security, and performance, – coherently and consistently on one display. In this flat view, this visualization does two things: 1) via the pattern of the rainfall it provides an easy overview of the network's performance, and 2) via color highlights, the system offers an effective alert mechanism for network-wide issues, as well as any emerging patterns. Thus, this design allows many specialist teams to be aware of the different types of issues via one central display.

**Abstracted network layout:** The Big Enterprise, for whom this visualization is designed for, has one large corporate headquarters with several data centers, and numerous global offices across six continental regions. To provide an accurate portrayal of this network, SpringRain divides the rainfall into several (seven in Fig.1.) columns, with each region's networks vaguely displayed according to their geographic north-south and east-west locations. Such abstraction allows the analysts to meaningfully view the entire enterprise network at once.

### 2.2 Layers of Awareness: Color, Motion, and Size

To facilitate the particular needs of hierarchically run control rooms, different data types and analysts, SpringRain uses color-coding to distinguish relevant data for the different issue teams. The gray base line, the color bar on top of the baseline, and the falling raindrop correspond to the three dimensions of information: network health, security, and performance (Fig.2). To create a visually pleasing atmosphere of spring rain we used the nature-centric colors of willow green, cherry red, and purplish gray.

**Health status:** The length and location of a baseline show the size and relative geographical location of this network. Its colors indicate its health status: Gray shows normal condition, and green hues indicate health related issues. The darker the green, the more severe the health issue is. Offices that are not responding (due to an outage, for example) are displayed as white ghost lines.

**Security status:** The red hues and length of an extra bar appearing on top of the baseline alarm of abnormal security conditions. The length of the bar shows how much of the network is affected.

**Performance status:** The color of the moving raindrops visualizes performance issues. It ranges from white to dark purplish gray. The speed of raindrops indicates network's speed. The resulting rainfall pattern makes it easy to distinguish, which regions have fast network connectivity and which regions are slow.

To ease the task of allocating an issue to an appropriate level specialist, SpringRain uses color density to differentiate between: 1) **normal condition:** white or gray for raindrop and baseline, respectively, 2) **routine issue:** pale color hue. Dashed lines warn of possible predicted issues, allowing for preventative action, 3) **non-routine issue:** medium color hue, and 4) **crisis issue:** bright color hue (Fig.2).

## 3 INTERACTION WITH GOOGLE GLASSES

With a manager centrally running the control room's workflow, the incorporation of Google Glasses gives SpringRain the advantageous capability to add seamless efficiency to control rooms' administrative processes. It allows operations managers to quickly evaluate the type and level of emerging issues and speedily allocate them to appropriate specialists. Furthermore, the Glasses allow for direct communication with local network managers across the Enterprise, as well as with the analysts within the control room. Importantly, this is available at the very moment when the manager analyzes an issue. To differentiate new issues from old ones, SpringRain is designed to display all new incoming issues thicker than the normal (gray) baselines, and shrink them down once they have been assigned to an analyst to solve (Fig.4).

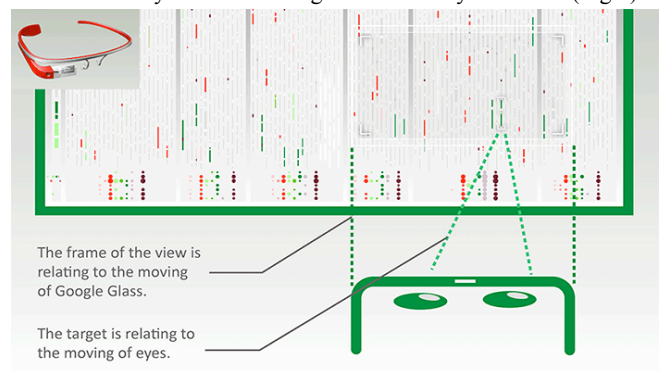


Figure 4: SpringRain's compatibility with Google Glasses allows for managerial efficiency in a hierarchically run network control room.

## 4 CONCLUSION

SpringRain's ambient information display accounts for the hierarchical and specialist structure of a computer network control room. To fit the needs of such structure, it offers a visually and structurally flat, scalable and accurate real-time visualization of a large-scale computer network. As a result, SpringRain allows for the effective management of specialist teams via one comprehensive display. Compatibility with Google Glasses further serves communicative efficiency and workflow.

## REFERENCES

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**Link:** SpringRain's Video: <http://vimeo.com/72361820>.