Visualizations to Improve Reactivity Towards Security Incidents Inside Corporate Networks

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About NEXThink

- Founded in September 2004
- Headquartered in Lausanne, Switzerland
- Develops and commercializes REFLEX™, a solution for Insider Threats Management based on research initially conducted at the AI Lab of the Swiss Federal Institute of Technology (EPFL)

Reactivity towards security incidents

- Why is reactivity important?
  - Minimize impact on business
  - Legal responsibility
    - Attacked network can become the source of another attack
    - Corporations have to take measures to report such incidents to authorities within an acceptable time period
- Security administrators are flooded by non-pertinent information

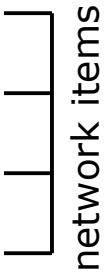
Our approach

- Visualization-based tools can help administrators to take quicker and better decisions

- However, we are facing two major challenges:
  - Lack of pertinent information
  - Amount of data to display

Lack of pertinent information

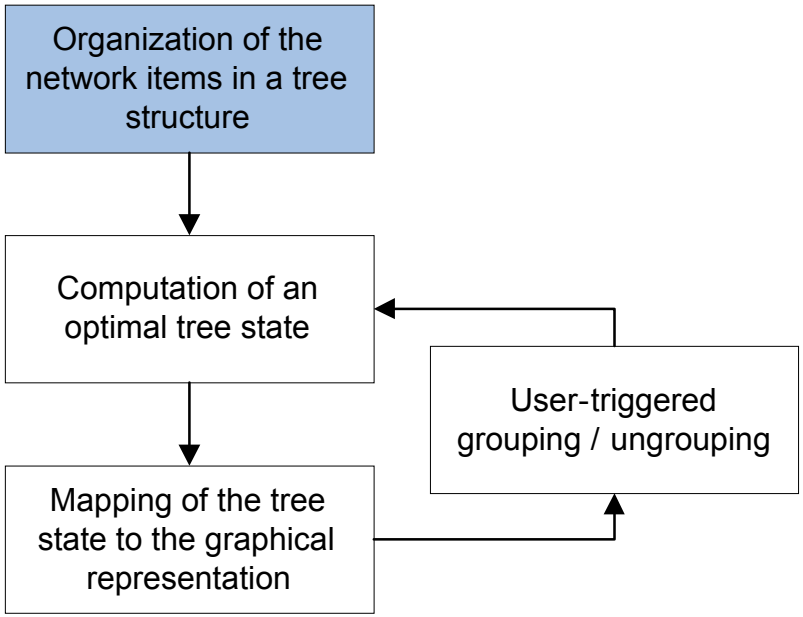
- Most current systems are based on a high number of low-level parameters
  - Decision process lengthened
  - Incertitude introduced
- We focus on a small set of certain high-level parameters for each connection
  - Time
  - User (e.g., Windows SID)
  - Application (e.g., firefox.exe)
  - Source host
  - Destination port and host



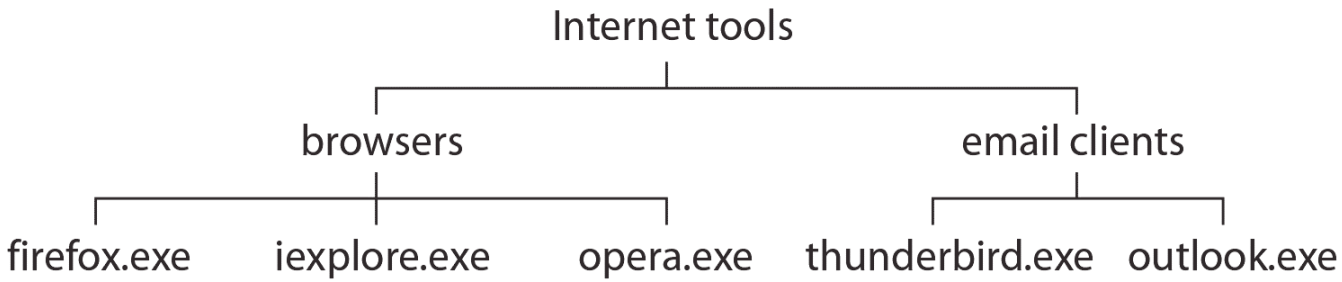
Amount of data to display

- Even when focusing only on pertinent data, we still have a lot of information to display
- Displaying that information with a fine granularity is clearly not feasible
- We introduce an interactive grouping technique for visualizations
  - Group similar information
  - Possible to drill down to get more precise information

Grouping technique



- Each node has a *state* attribute
  - *collapsed* = displayed as a group
  - *expanded* = children displayed individually



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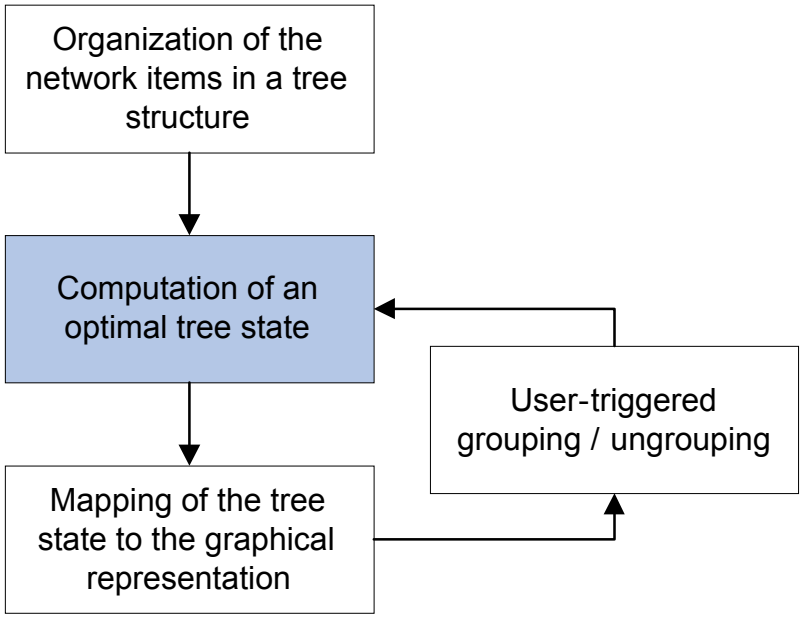
Grouping technique (2)



- Computing a tree state means setting the *state* attribute of each node
- It has to respect some constraints

- Screen real estate is limited and each network item (or group) needs a minimal amount of space
- The maximum number of network items (or groups) should be displayed
- The user actions (manual grouping / ungrouping) have to be respected

Visualizing connections

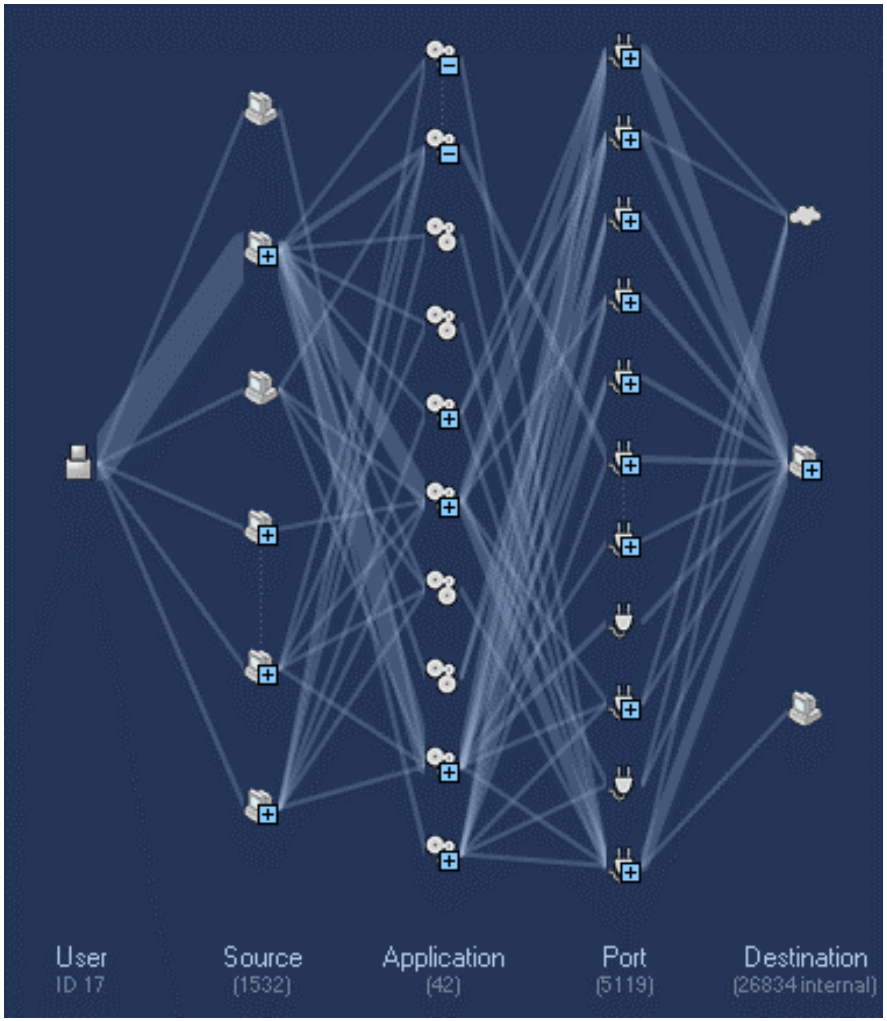
- To take the right decision, security administrators need first to understand generated alarms
  - Rule-based systems: alarms easy to understand
  - Anomaly-based systems: alarms difficult to understand
- Our claim: To understand what is abnormal, one needs first to understand what is normal
- We want to display normal connections along with alarms

Visualizing connections (2)

- Connections can be seen as tuples <time, user, application, source host, destination port, destination host>
- A parallel-coordinates visualization is a good idea to display such information
- However, there are challenges related to the number of lines to be drawn
  - It becomes quickly unreadable and therefore unusable
  - It is prone to deception attacks

Visualizing connections (3)

- Our grouping technique and the abstraction of time reduce dramatically the number of lines



More than 17 millions connections displayed in a parallel-coordinates visualization

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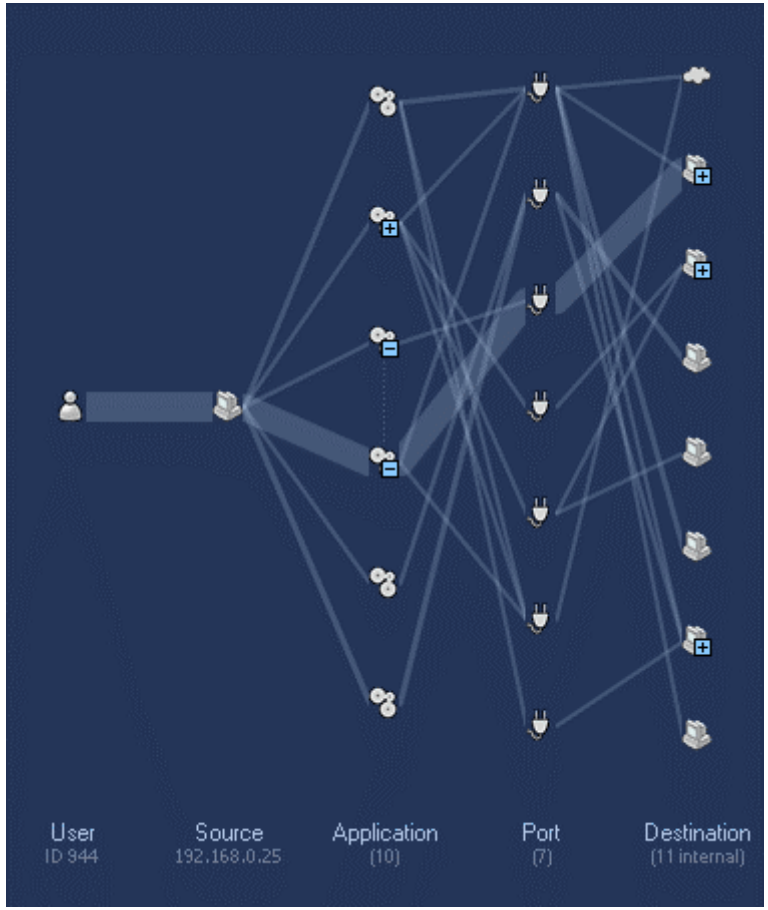
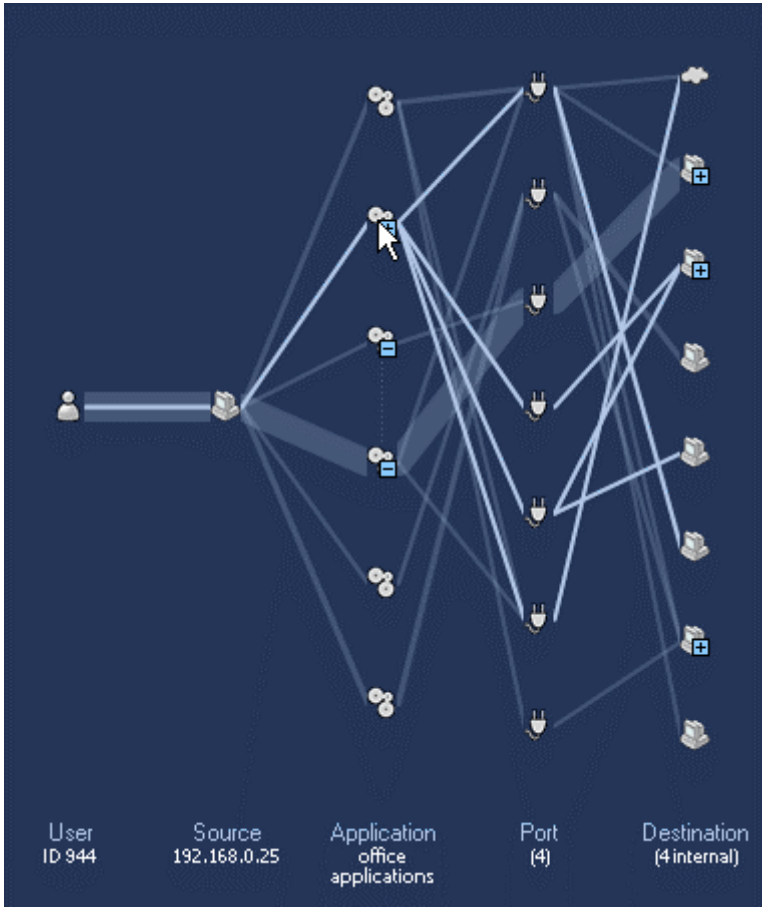
Visualizing connections – Interaction



Visualizing connections – Interaction (2)



The mouse cursor is moved over office applications and corresponding connections are highlighted

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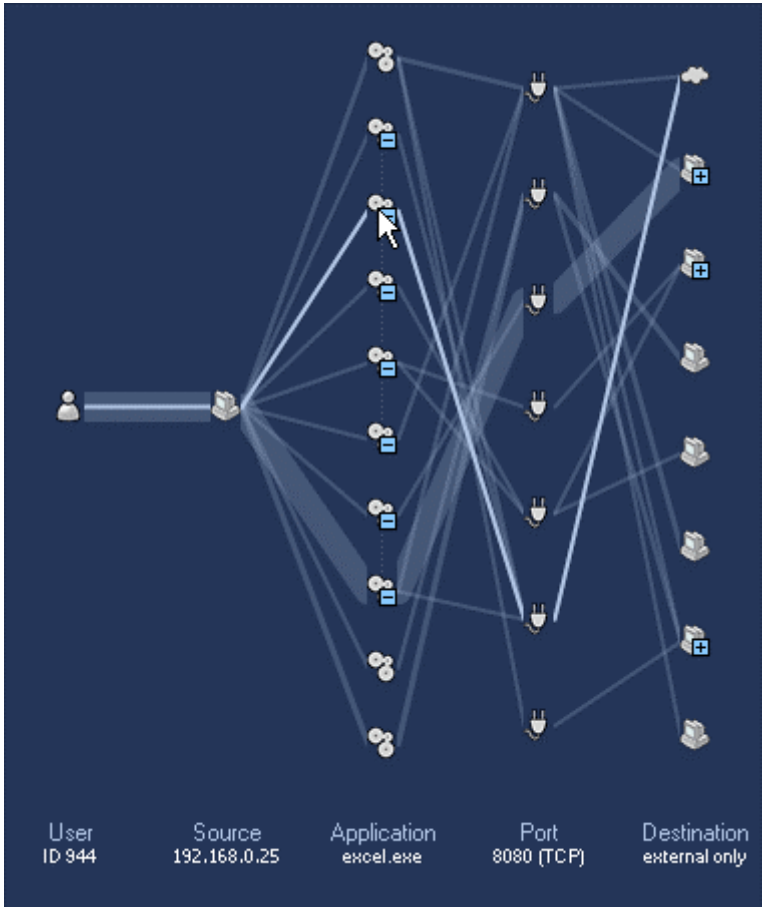
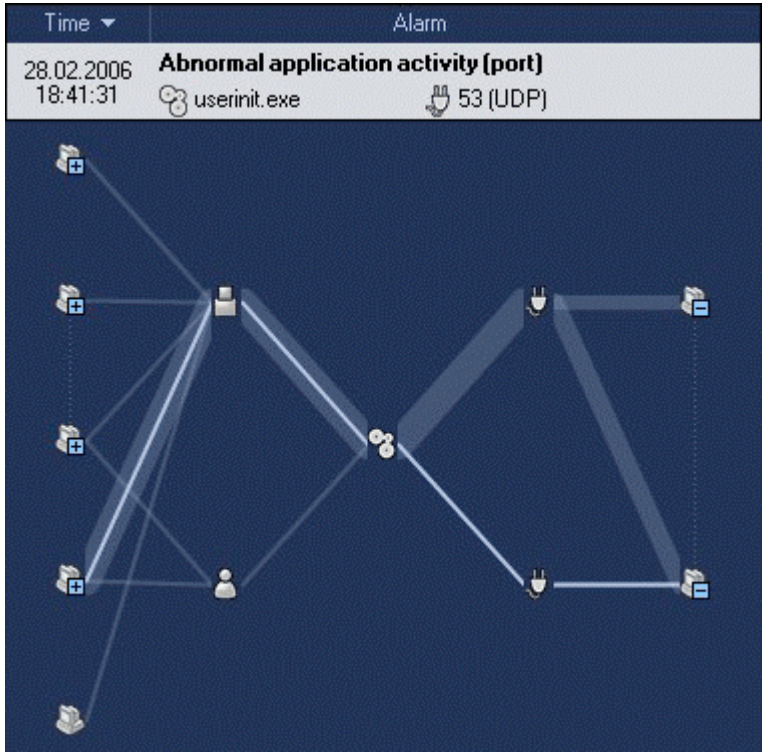
Visualizing connections – Interaction (3)



Office applications are ungrouped to provide a more detailed view

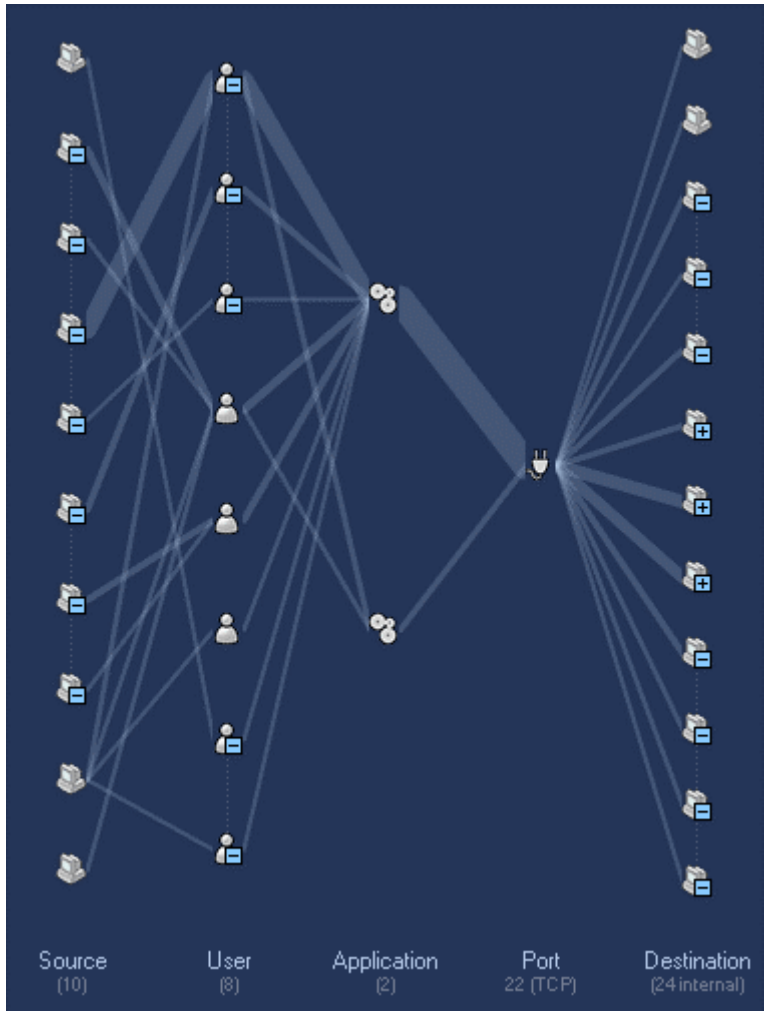
Usage scenario I – Why was this alarm generated?



- One can clearly see that this application usually makes connections through another port

Usage scenario II – Who is using port 22?

- The port 22 is often open for SSH communication but who is using it, with which applications and to connect to which computer?
- If one want to close that port, who will be affected?

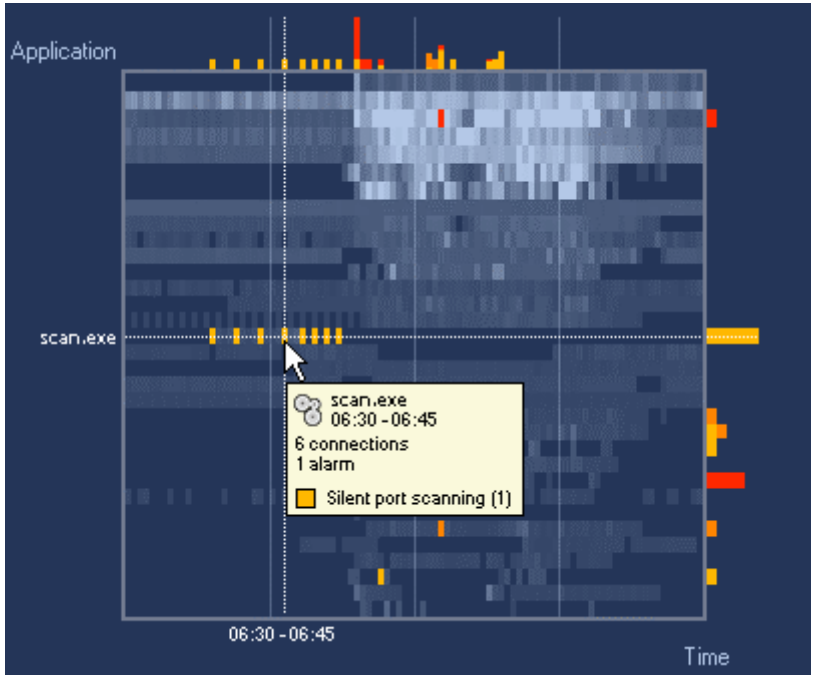


Visualizing activity and alarms over time

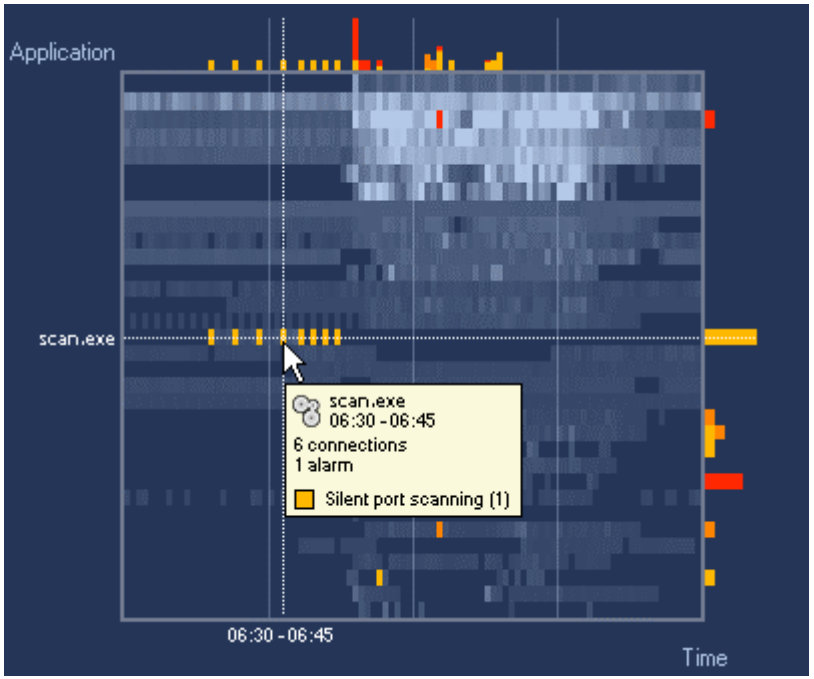
- Parallel-coordinates visualizations are useful to help understand single alarms but not to see correlations between alarms
- We use a visualization based on a scatterplot to display activity and alarms over time
  - X-axis represents the time
  - Y-axis represents a type of network items (i.e., either users, applications, sources, ports or destinations)
- Our grouping technique helps to limit the number of rows

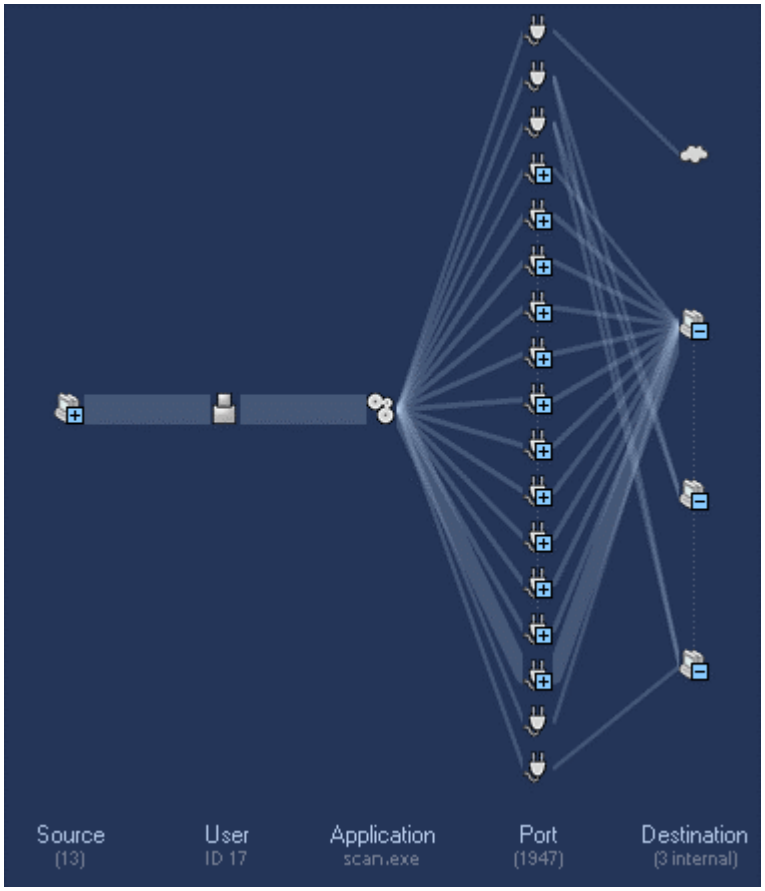
Visualizing activity and alarms over time (2)

- Brighter blue indicates more activity
- Colored rectangles represent alarms
- The visualization is augmented by two histograms representing the sum of alarms by time (on the top) and by network item (on the right)



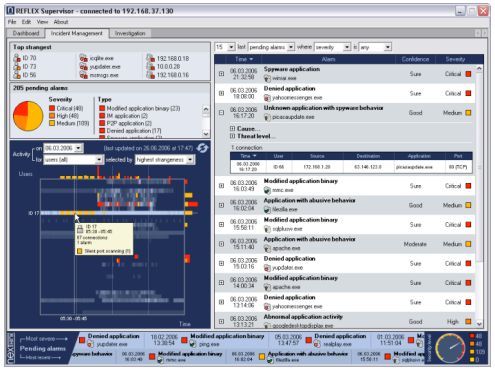
An example

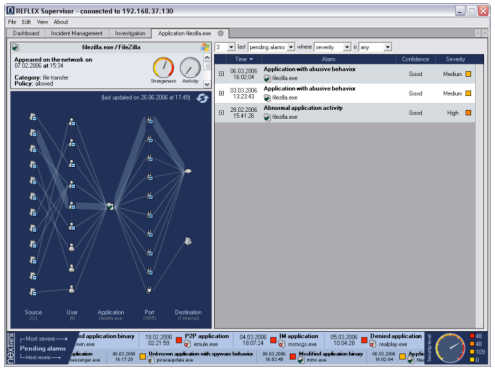




Conclusion

- A new approach to build visualizations based on pertinent information and a grouping technique has been presented
- Presented visualizations are part of REFLEX™ commercialized by NEXThink





Thank you for your attention!!

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