

# Impact of Network Performance on the C<sup>2</sup> Mission: Visualization for Network Awareness

Brian McKenna, James Gualtieri, & William Elm  
Resilient Cognitive Solutions, LLC

[www.resilientcognitivesolutions.com](http://www.resilientcognitivesolutions.com)



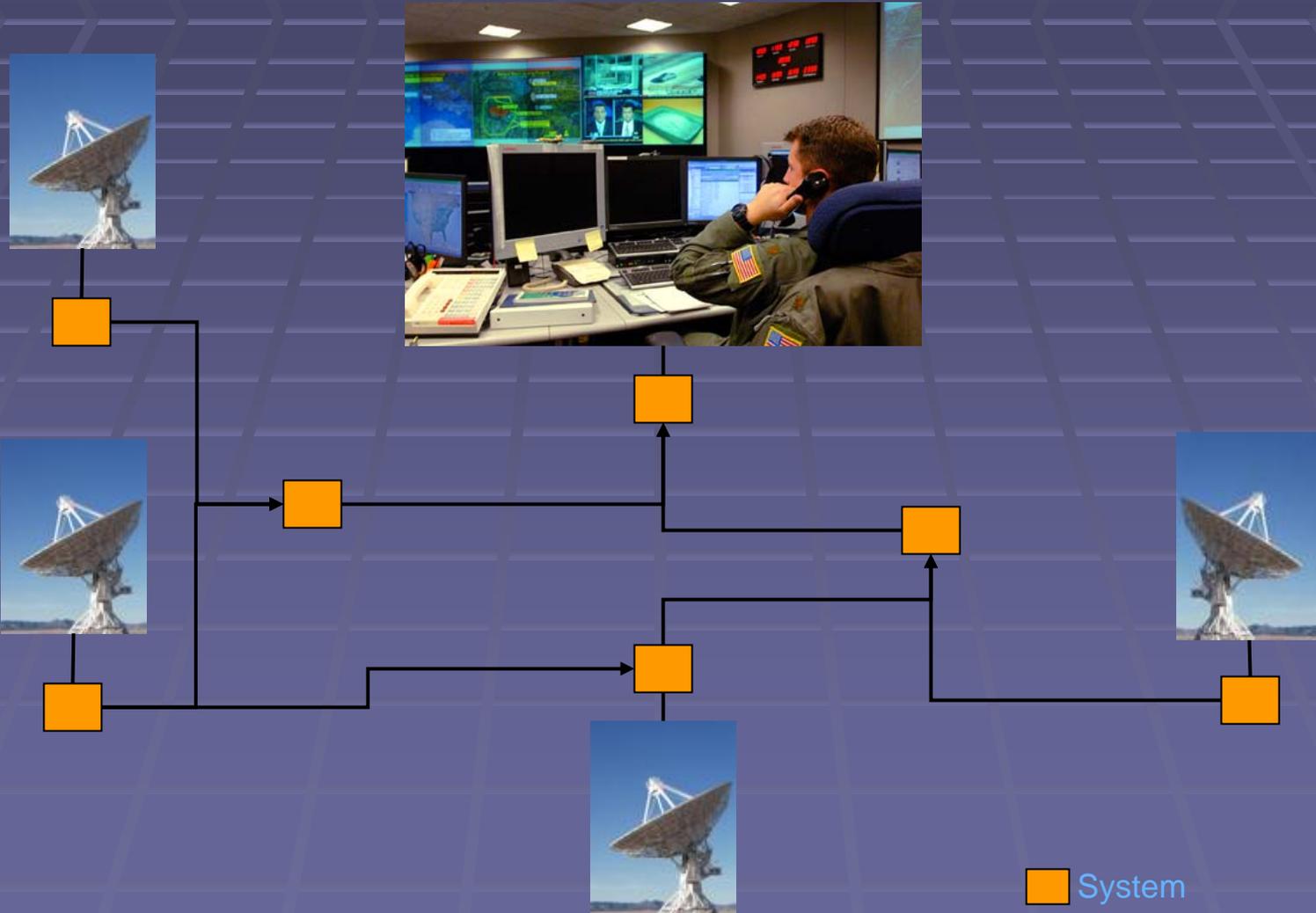
# Network Monitoring is vital for good C<sup>2</sup> decision-making

- Get Command Center information from sources as early as possible
  - GIG, DCGS, NCCT
- Disruptions affect decision-making processes
- As main users of Network, Command Center has large stake in management



www.chips.navy.mil

# Role of Networks



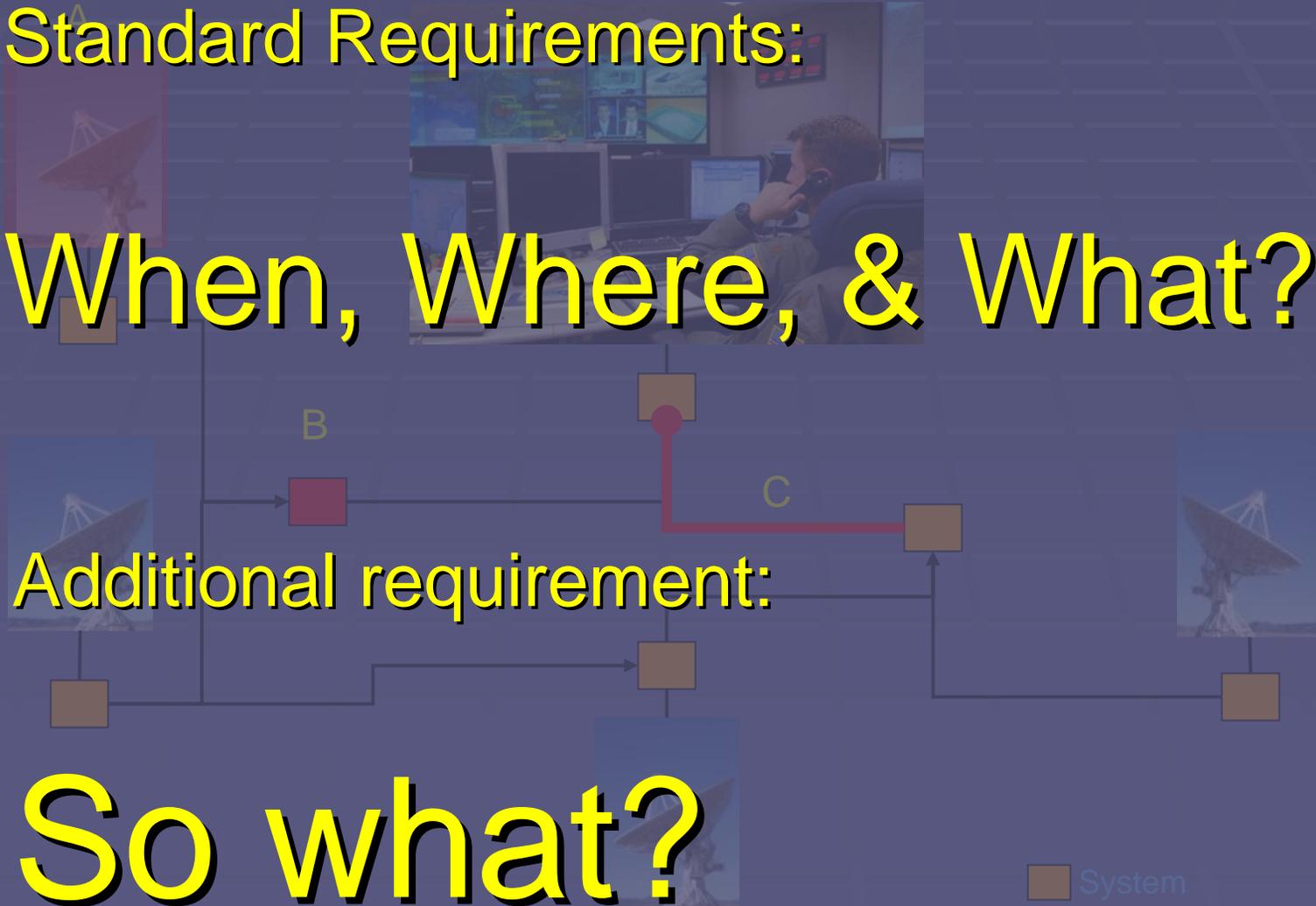
# Potential Problems

Standard Requirements:

When, Where, & What?

Additional requirement:

So what?



# Standard Network Monitoring Tools

Physical representations are necessary but not sufficient for effective network monitoring

**Alarms Log**

Timestamp	Category	Severity	Info	Acknowledged	Created By	Count
2004.11.23 at 13:18:48	Loss Of Signal (1002)	Major	LIM 127.0.0.1		Superuser	1
2004.11.23 at 13:21:16	Loss Of Signal (1002)	Major	LIM 127.0.0.1		Superuser	1
2004.11.23 at 13:23:11	Out Of Service (2002)	Major	LINK (9225.2)		System	1
2004.11.23 at 13:24:14	Mass Call Alarm (5004)	Warning	Alarm id (Mass C		System	1
2004.11.23 at 13:26:12	ASR Alarm (5001)	Minor	249/Massa info		System	1
2004.11.23 at 13:28:49	ASR Alarm (5001)	Minor	249/Massa m		System	1
2004.11.23 at 13:29:00	ASR Alarm (5001)	Minor	249/Massa m		System	1

**Active Alarms**

Timestamp	Category	Severity	Info	Acknowledged
2004.11.25 at 16:20:26	Level 1 OK (1001)	Major	LIM 127.0.0.1 PC	
2004.11.25 at 16:20:32	Mass Call Alarm (5004)	Warning	Alarm id (Mass C	
2004.11.25 at 16:20:51	Loss Of Signal (1002)	Major	LIM 127.0.0.1 PC	
2004.11.25 at 16:21:08	Mass Call Alarm (5004)	Warning	Alarm id (Mass C	
2004.11.25 at 16:21:47	Out Of Service (2002)	Major	LINK (8940.2) - 0	
2004.11.25 at 16:22:12	Transfer prohibited (3301)	Minor	LINK (8940.2) - 0	

Time Filter: From Time: Fri 22 Nov 2004 16:00:00 To Time: Sat 25 Nov 2004 17:00:00

Group Filters: AND, OR

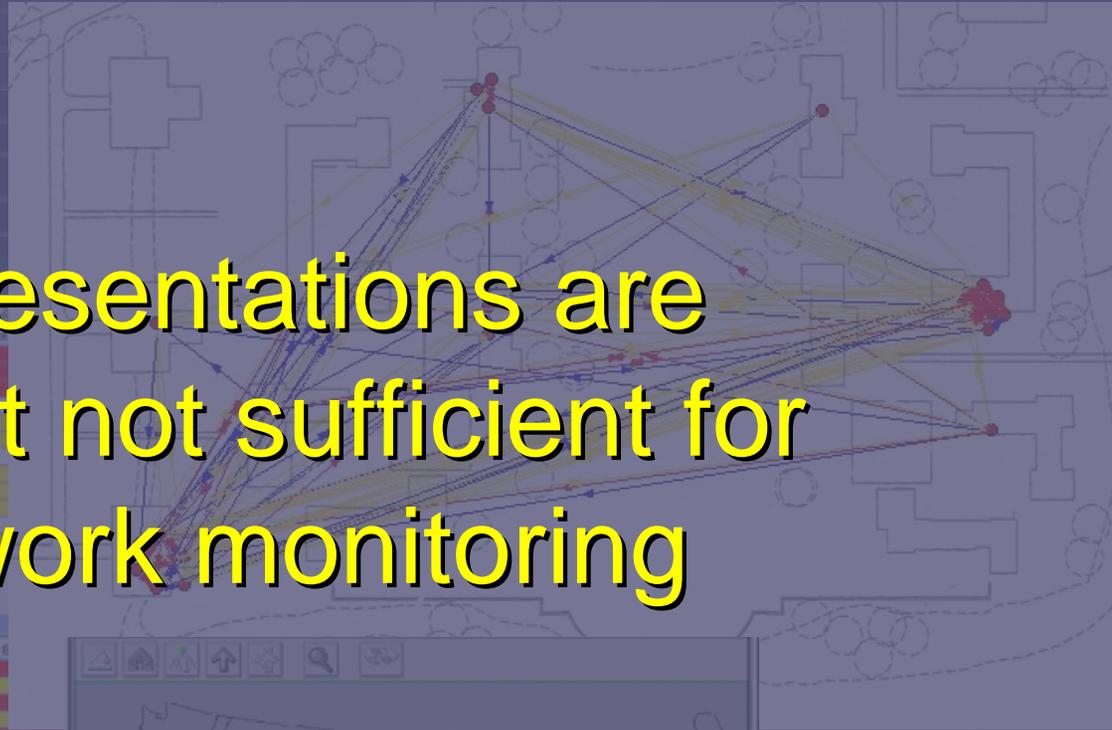
Query: Update

Condition: Type: Level 1 Add Row Delete Row

Group Filter: Active Filter

Clear Alarm Acknowledge Alarm

Number of rows in view: 6



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# Original Display Design



# Technology-based solution

Network Monitoring

Dynamic Page - Highest Possible Classifications

Unclassified - For Official Use Only

File Help

Outflow to Sup  Remote Office  Corp. Office  Voice Recognition  Summary  All Groups

Wav Documents  Voice to Text  Supplier Mail  Corporate Mail  Inflow from Suppliers

Trend Analysis  Decrypt  Excel Archive  HTML Documents  Text Archive  Keyword Index

Access Documents  Text Documents  Excel Documents  Movie Documents  Macros

Convert to PDF  Translate  Dictionary  PowerPoint Documents  Keyword Search

<b>Convert to PDF</b> 	<b>Translate</b> 	<b>Dictionary</b> 
<b>PowerPoint Documents</b> 	<b>Keyword Search</b> 	<b>Access Documents</b> 
<b>Text Documents</b> 	<b>Excel Documents</b> 	<b>Movie Documents</b> 
<b>Macros</b> 	<b>Trend Analysis</b> 	<b>Decrypt</b> 
<b>Excel Archive</b> 	<b>HTML Documents</b> 	<b>Text Archive</b> 
<b>Keyword Index</b> 	<b>Wav Documents</b> 	<b>Voice to Text</b> 
<b>Supplier Mail</b> 	<b>Corporate Mail</b> 	<b>Inflow from Suppliers</b> 
<b>Outflow to Suppliers</b> 	<b>Remote Offices</b> 	<b>Corporate Office</b> 
<b>Voice Recognition</b> 		



# Known Problems

- Unable to scale, even with group alarms
- Does not provide the “so what” impact
- Overburdens users with cognitive work

## Design Solution

- Allows monitoring 100,000+ data points on a single display
- Functional representation provides Mission impact
- CSE-based design allows for easier network management



# ACSE-based redesign

The screenshot displays a software application window titled "Longshot v 2" with a menu bar containing "File" and "Help". The main workspace is a grid of tool icons for document processing, including "Text Documents", "Convert to PDF", "Macros", "Image Documents", "Text Archive", "Translate", "Dictionary", "Keyword Search", "Keyword Index", "Powerpoint Docs.", "Flash Documents", "Access Docs.", "Movie Documents", "Excel Documents", "HTML Documents", "Decrypt", "Trend Analysis", "Excel Archive", "Text Arch", "Voice to Text", "WAV Archive", "WAV Documents", "Voice Recognition", and "Supplier Mail".

Two vertical panels are positioned on the sides:

- Remote Locations:** A panel on the left side, containing a list of locations and a search field.
- Corporate Office:** A panel on the right side, containing a list of locations and a search field.

Text overlays on the image include:

- "Remote Locations" on the left side panel.
- "Home Office processing of information from remote locations" in the center of the workspace.
- "Home Office Locations" on the right side panel.

# See Mission Impact of Network Problems

**Analytic Requirements receiving messages that use Excel Documents\_Excel Documents 18\_ABC**

Intelligence Need Analytic Requirement	Queue Dependency	Priority
<input type="checkbox"/> Monitor rival, anti-government group of Bahamas in the aftermath of Hurricane Charles.		4, 4, 3 2, 3 LFH MFH
<input type="checkbox"/> Analyze communications between 5 assumed leaders of rival faction for evidence of a coup.		4, 4 2
<input type="checkbox"/> Identify all people using radio communications within the grid region 84B		4, 3 3

Missions dependent on a system

Systems being used for a particular mission

**Current Message Locations for Analytic Requirement #1734**

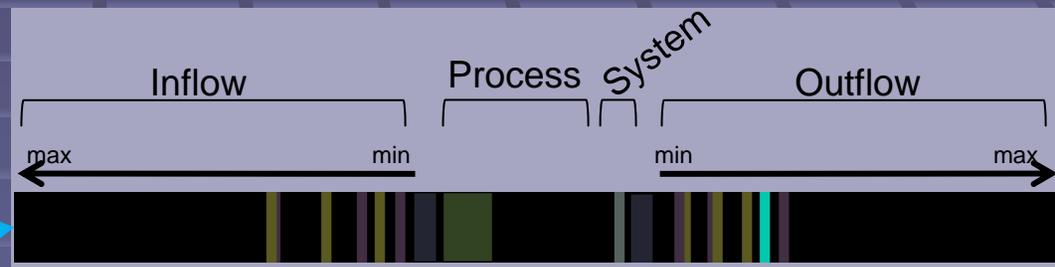
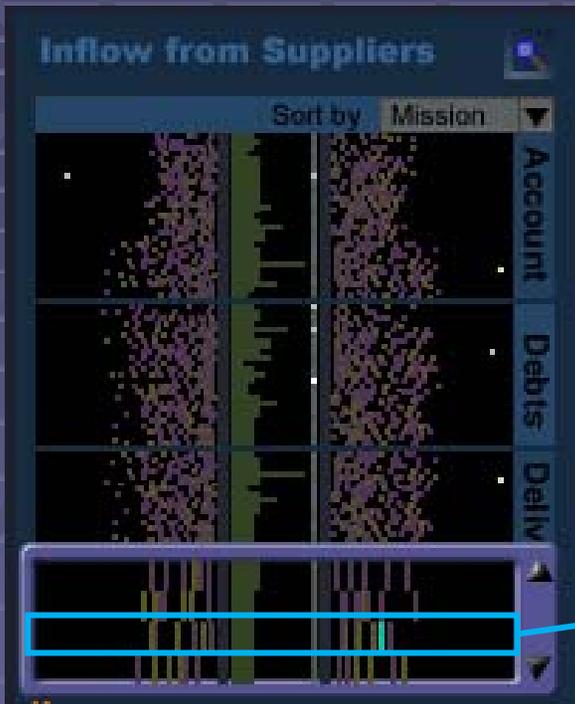
AR #1734 - Analyze communications between 5 assumed leaders of Bahama rival faction for evidence of a coup	Count	Queue	System	Queue	Count
	112 / 140 / 350	In Queue 001	Remote Offices_System 4	Out Queue 006	14 / 42 / 85
	18 / 32 / 196	In Queue 011	Remote Offices_System 26	Out Queue 004	3 / 17 / 84
	80 / 80 / 100	In Queue 004	Remote Offices_System 117	Out Queue 018	21 / 23 / 45
	200 / 280 / 350	In Queue 018	Supplier Offices_System 41	Out Queue 021	103 / 103 / 425
	62 / 312 / 700	In Queue 008	Supplier Offices_System 108		
	37 / 38 / 80	In Queue 001	Text Documents_System 14	Out Queue 003	300 / 330 / 680
	249 / 340 / 340	In Queue 007	Convert to PDF_System 9	Out Queue 004	21 / 42 / 90
	71 / 84 / 108	In Queue 004	Convert to PDF_System 9	Out Queue 017	88 / 94 / 200
	31 / 40 / 140	In Queue 010	Keyword Search_System 18	Out Queue 015	130 / 280 / 300
	64 / 64 / 200	In Queue 003	Corporate Mail_System 35	Out Queue 003	5 / 10 / 115
			Corporate Office_System 7	Out Queue 009	9 / 0 / 59
			Corporate Office_System 13	Out Queue 002	94 / 97 / 106
			Corporate Office_System 51	Out Queue 008	61 / 74 / 250
				Out Queue 011	15 / 80 / 158

Find a Mission:  
Bahama  
Search Clear

AR total / enterprise total = 1,579 / 26,848  
Queues used = 23



# CSE principle 1: Data Context



Placing data in the right context provides meaning to those data, easing the cognitive work of the user

# CSE principle 2: Directing Attention



Users doesn't have to pull information from the system to make a decision

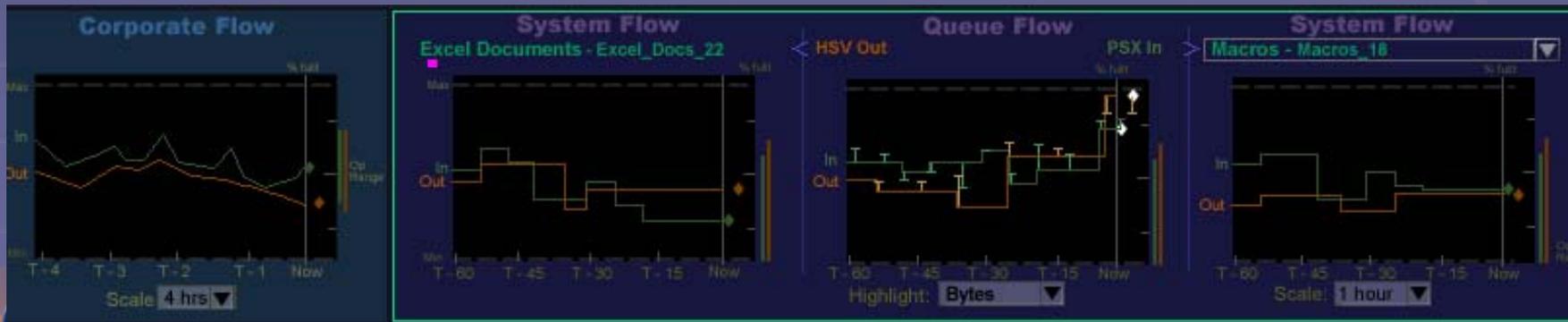
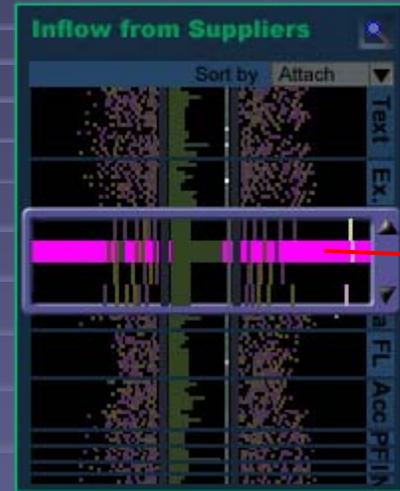
Important events in the network draw the operator's attention with enough context

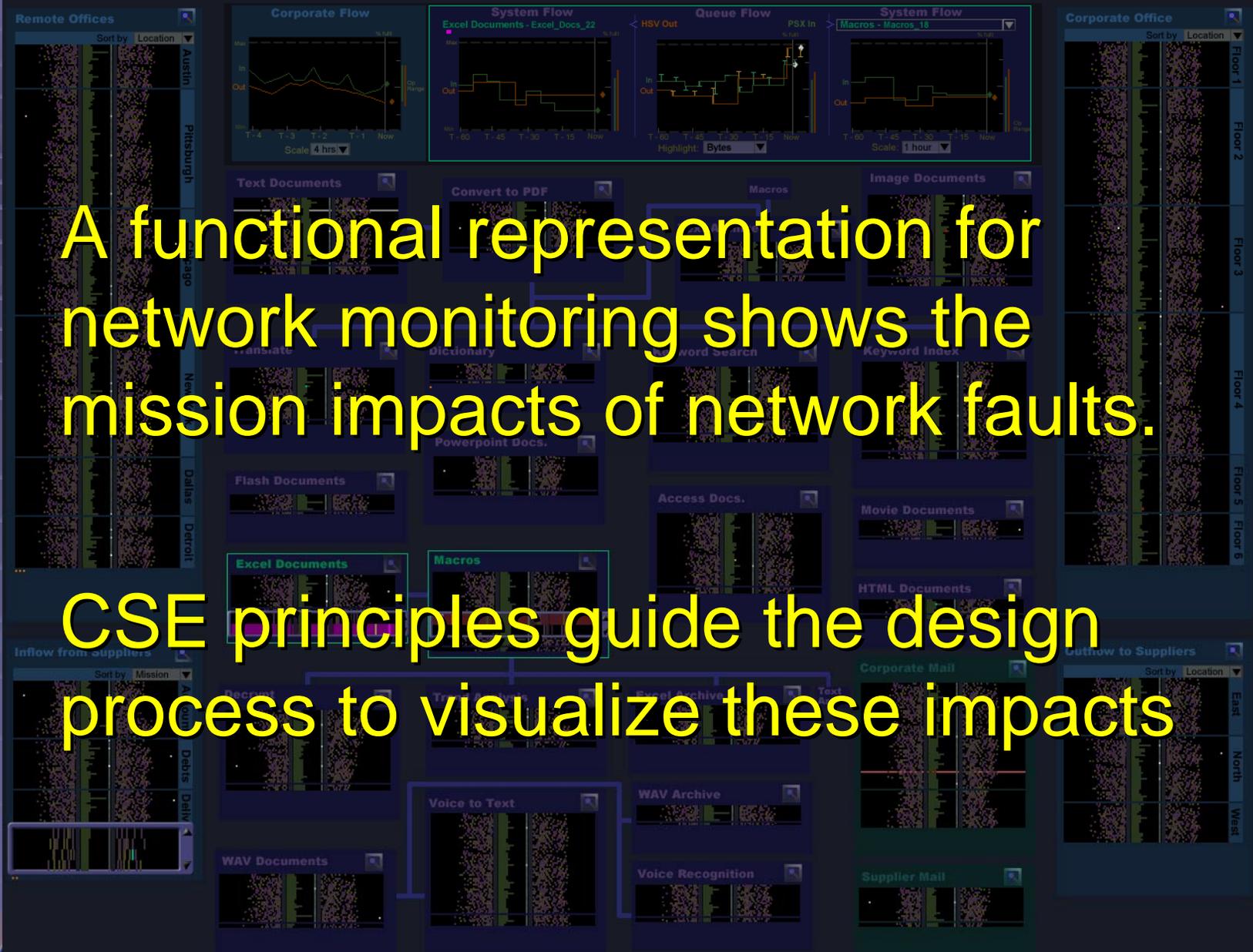
# CSE principle 3: Observability

See upstream and downstream connections

- Externalize Expertise

History of a selected queue / systems can be viewed





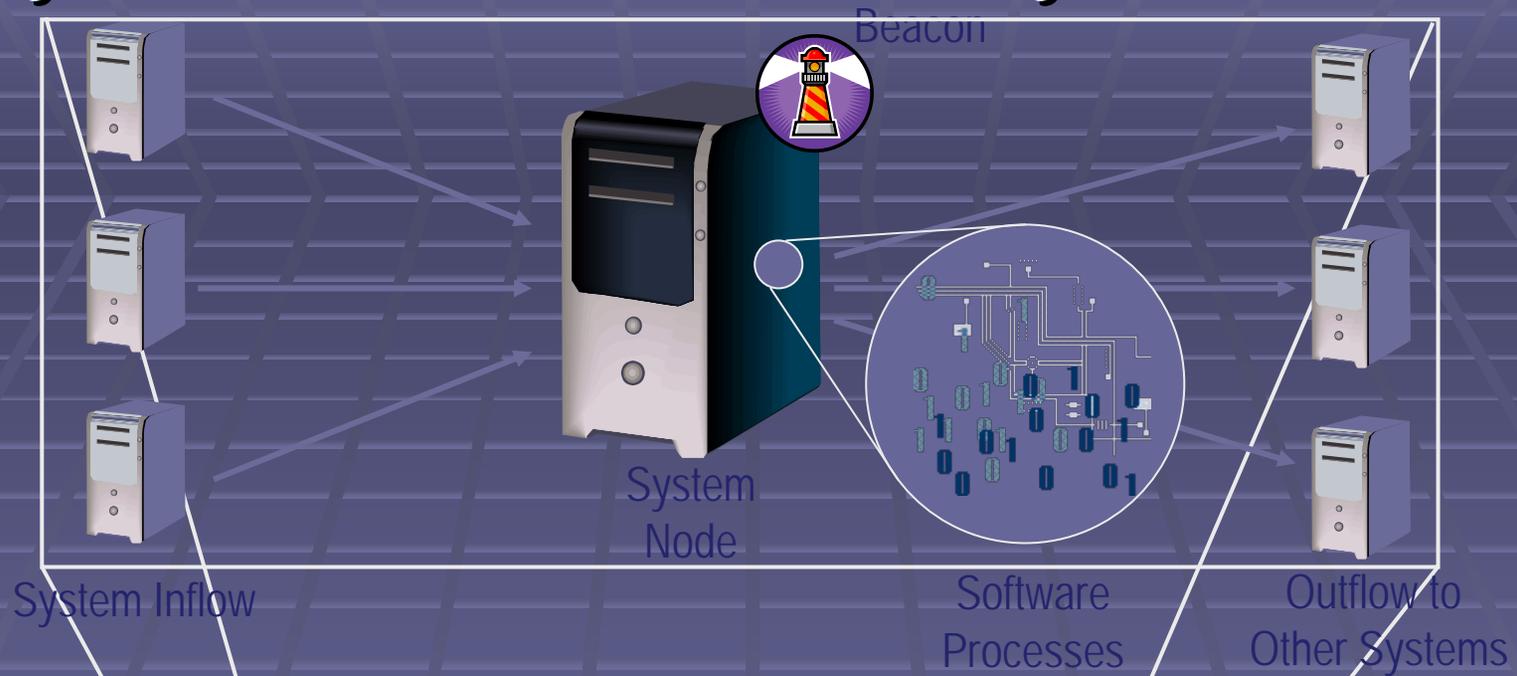
A functional representation for network monitoring shows the mission impacts of network faults.

CSE principles guide the design process to visualize these impacts

# Questions?



# Physical Picture of a system node



1 system node corresponds to 1 row



# Display comparison for color anomalous viewers

Through the eyes  
of a protanope

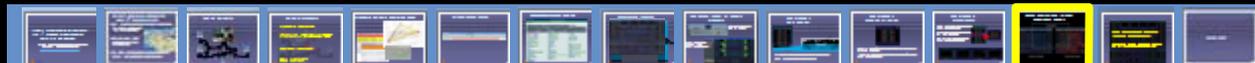


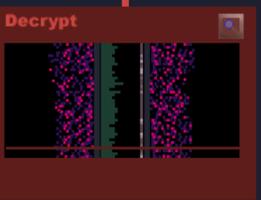
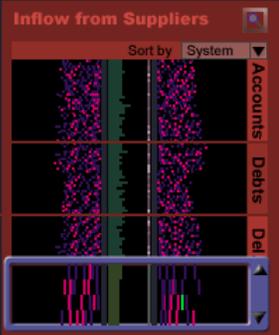
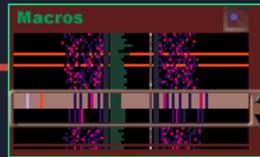
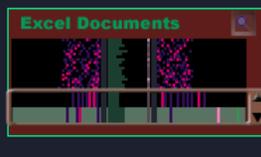
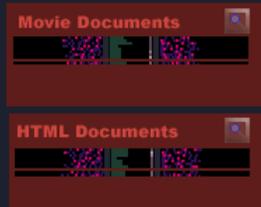
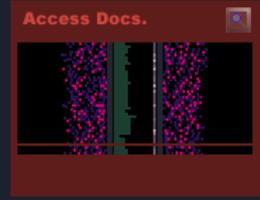
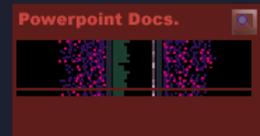
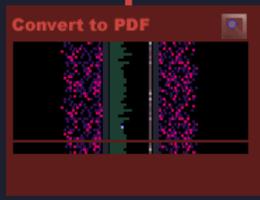
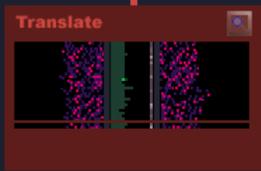
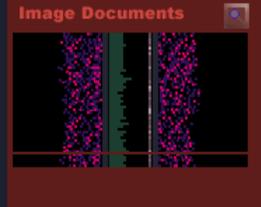
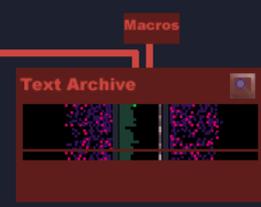
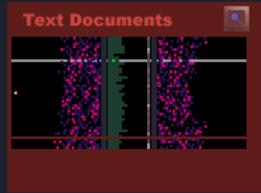
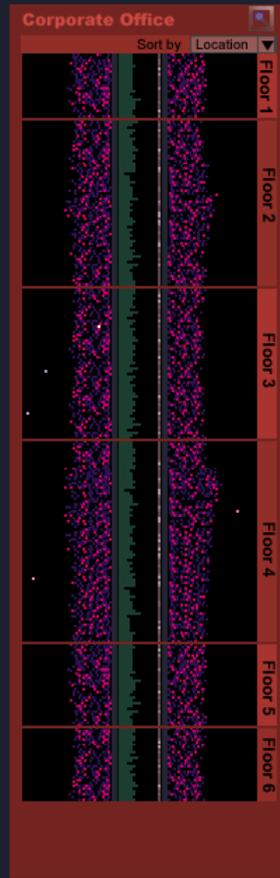
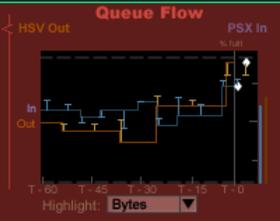
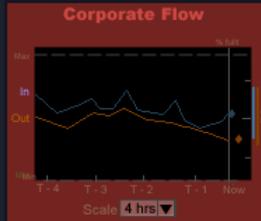
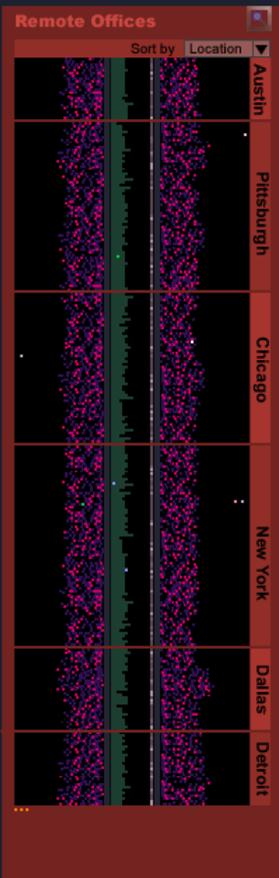
Standard Display



Protanope Display

\*Image conversion done through filter developed by Vischeck





Text Arch

