

The Building Blocks of Clinical Systems

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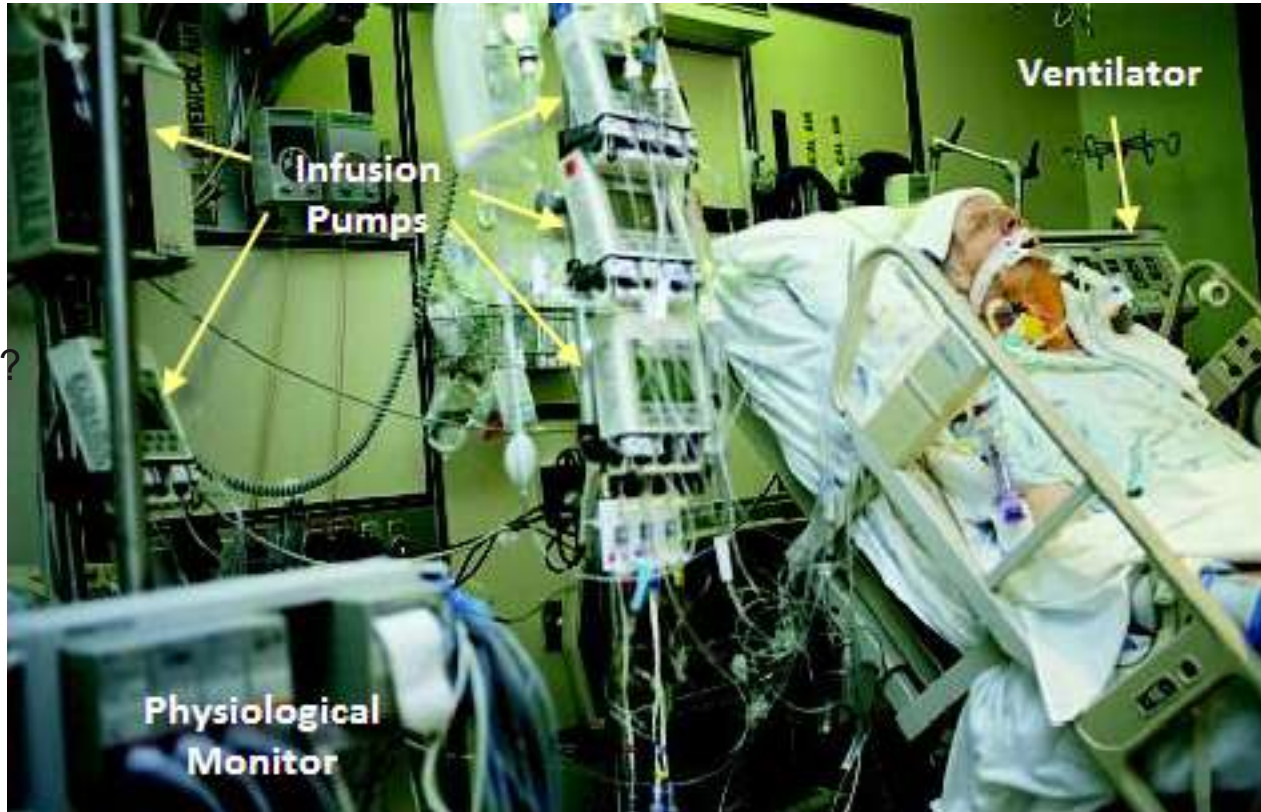
CTO and Co-Founder DocBox Inc

The Reality

14 drugs are being administered
~ 1 is changed every 15 minutes.

Right orders?

The patient was moved, what's their history?



Right infusion rates?

Right patient??

Allergies?

When was his last blood draw what were the results?

Which alarm went off, What is Error 45?

Um, what was that procedure again?

The "vitals" changed, what else changed?
...what were they 5 minutes ago? ..15?

What happened last shift?

- Health Care is the combination of many systems including people, IS, medical devices and the patient
- Designing any part of a system without an understanding how it will be used within the system will cause unintended consequences
- If you assume there is 340 values measured in a standard critical care scenario then you have

5.10×10^{714} unique combinations of the data

System of Systems

- Medical Device Types cannot be the primary components of the system of system because of their variability in functionality.
- Using functionality of devices allows for innovation
- Early work has shown that there is a common set of building blocks within all clinical systems.

Examples:

- Collect Data
- Send Data
- Compare Data
- Send External Command

Currently it has found that there is ~30 of these components this means there is now only 2.65×10^{32} combinations

Borrow Some Technology!!

- Other systems of systems industries use methods to understand complex systems
- Aviation has used simulation since 1934, currently not a single rivet is placed before a complete systems of systems simulation occurs in new aircraft.
- All US Defense Department Technology Deployments require a systems of systems simulation to understand how the technology impacts the system.
- Computing power has allowed for what was once 300 hours of analysis to only 30 hours

necessary to analyze a system as complex as a clinical environment.



Civil Nuclear Power

Specializing in Training, Simulation, and Support

VIRTUAL WORLD LABS

Working with LM Nuclear Systems and Solutions (LMNCS) within LM-MFC (Archbald, PA) Virtual World Labs developed this immersive and interactive experience in less than 2 weeks using only a single PPT slide, reference imagery, and the digital screen-grabbed images provided by Pacific Gas & Electric (PG&E).

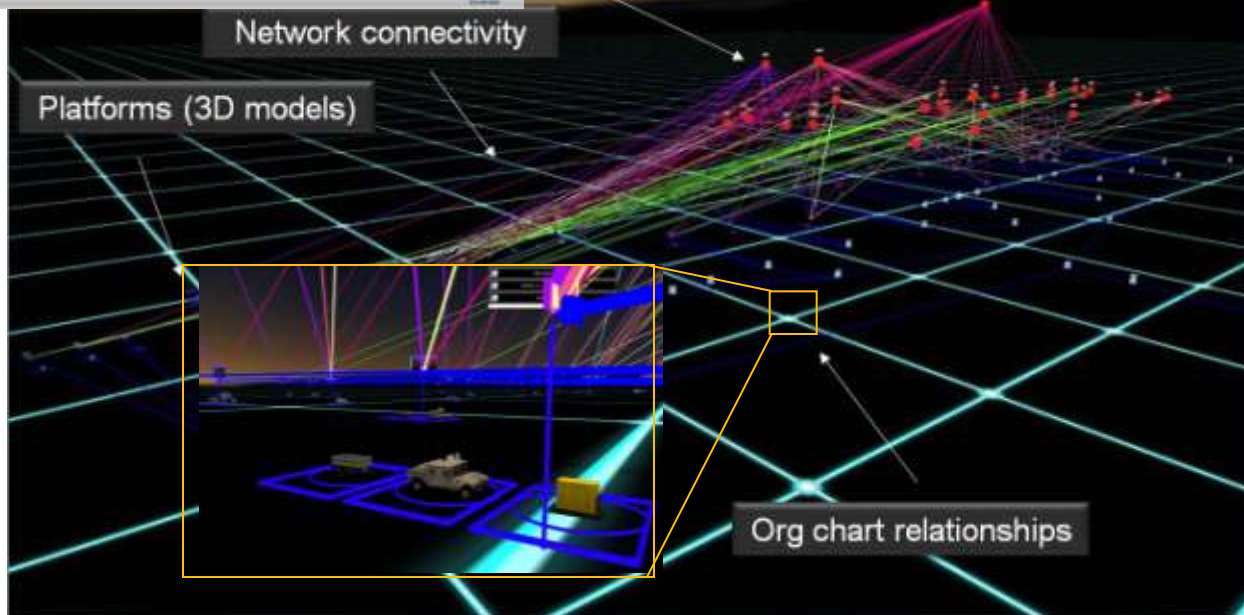
Using UltraSim, this application allows the user to freely navigate through the virtual Digital Nuclear Control Room using Google-Earth style navigation.

In addition, the user can select any desktop display, and assign its video feed to any of the wall-mounted displays - providing a means to study aspects of Human Factors Engineering as they apply to the design of the Digital Control Room.

Providing a better way to "Reinvent How People Prepare for Their Tomorrow."



Lockheed Martin - Simulation, Training and Support



Conclusions

- Utilize Function Blocks of instead of device types to understand how systems interact with each other
- Utilize existing analysis methodologies to move towards certification methods for systems of systems.

Special Thanks

- CIMITs MDPnP Team
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- Lockheed Martin Simulation and Training Systems Virtual World Labs