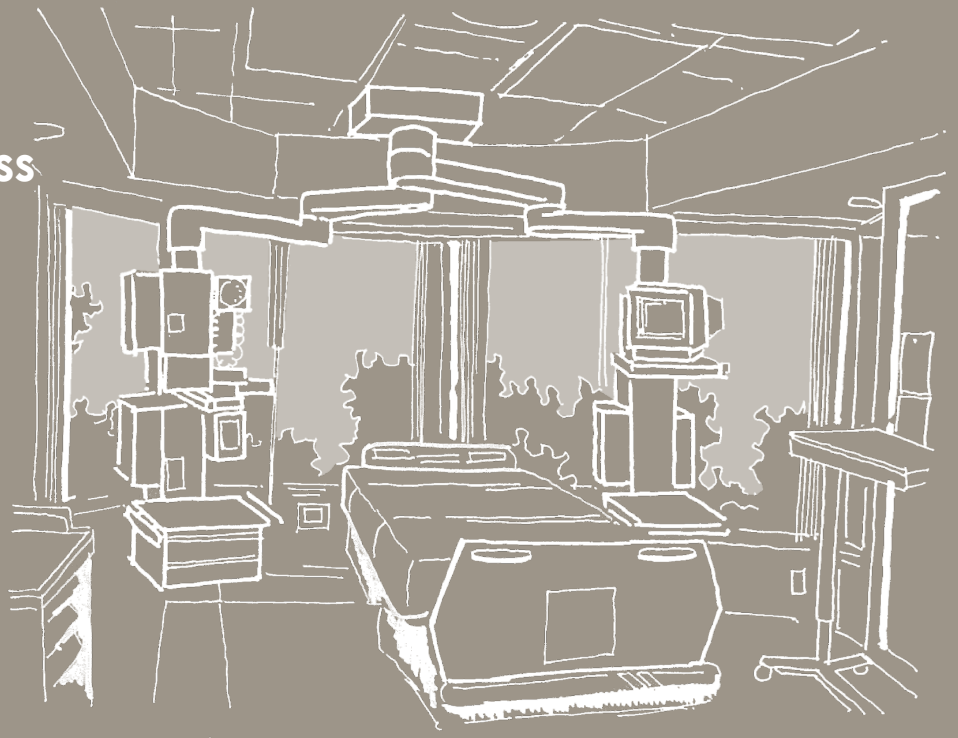
Intensive Care Unit Design

25 Years of Winning Trends

European Healthcare Design Congress
London, United Kingdom
June 27, 2016



Diana Anderson, MD, MArch
Dochitect, Stantec Architecture

“The hospital is a human intervention and as such, can be reinvented at any time.”

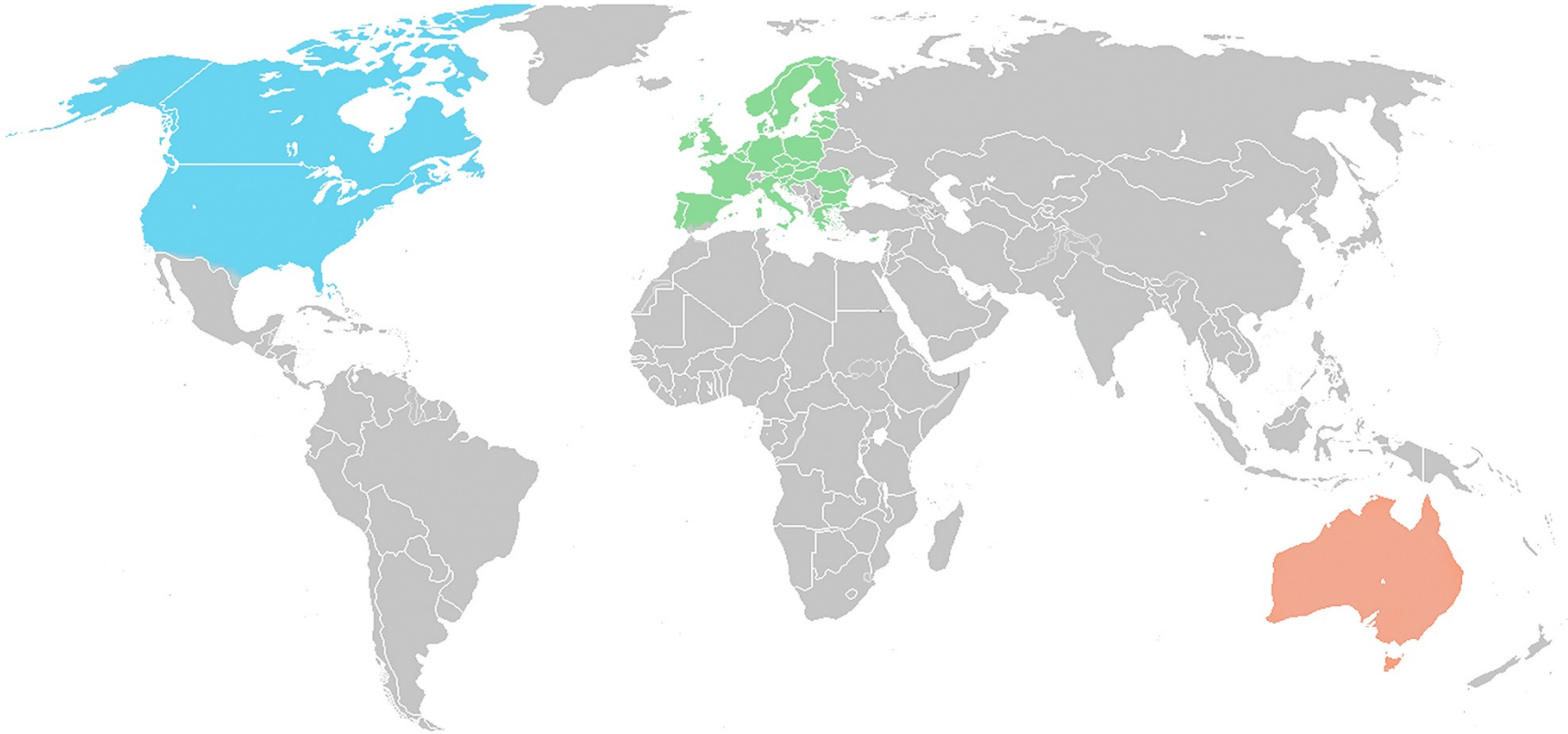
– Leland Kaiser, Hospital Futurist

ICU Design of Tomorrow

What Can We Expect?

From National to Global Design Submissions

25 Years of Winning Designs



Society of Critical Care Medicine
The Intensive Care Professionals

THE AMERICAN INSTITUTE OF ARCHITECTS

AACN AMERICAN ASSOCIATION of CRITICAL-CARE NURSES

Guidelines for Intensive Care Unit Design
2012 Critical Care Medicine

Guidelines for intensive care unit design*

Dan R. Thompson, MD, MA, FACP, FCCM (Co-Chair); D. Kirk Hamilton, FAIA, FACHA (Co-Chair); Charles D. Cadenhead, FAIA, FACHA, FCCM; Sandra M. Swoboda, RN, MS, FCCM; Stephanie M. Schwindel, MArch, LEED; Diana C. Anderson, MD, MArch; Elizabeth V. Schmitz, AIA; Arthur C. St. Andre, MD, FCCM; Donald C. Axon, FAIA, FACHA†; James W. Harrell, FAIA, FACHA, LEED AP; Maurene A. Harvey, RN, MPH, MCCM; April Howard, RN, CCRN, CCRC; David C. Kaufman, MD, FCCM; Cheryl Petersen, RN, MBA, CCRN

Objective: To develop a guideline to help guide healthcare professionals participate effectively in the design, construction, and occupancy of a new or renovated intensive care unit.

Participants: A group of multidisciplinary professionals, designers, and architects with expertise in critical care, under the direction of the American College of Critical Care Medicine, met over several years, reviewed the available literature, and collated their expert opinions on recommendations for the optimal design of an intensive care unit.

Scope: The design of a new or renovated intensive care unit is frequently a once- or twice-in-a-lifetime occurrence for most critical care professionals. Healthcare architects have experience in this process that most healthcare professionals do not. While there are regulatory documents, such as the ***Guidelines for the Design and Construction of Health Care Facilities***, these represent minimal guidelines. The intent was to develop recommendations for a more optimal approach for a healing environment.

Data Sources and Synthesis: Relevant literature was accessed and reviewed, and expert opinion was sought from the committee members and outside experts. Evidence-based architecture is just in its beginning, which made the grading of literature difficult, and so it was not attempted. The previous designs of the wi… American Institute of Architects, American Ass… Care Nurses, and Society of Critical Care M… Unit Design Award were used as a refer… meeting repeatedly, both in person and … force met to construct these recomm…

Conclusions: Recommendations f… units, expanding on regulatory gui… possible healing environment, and … workplace. (Crit Care Med 2012; 40…

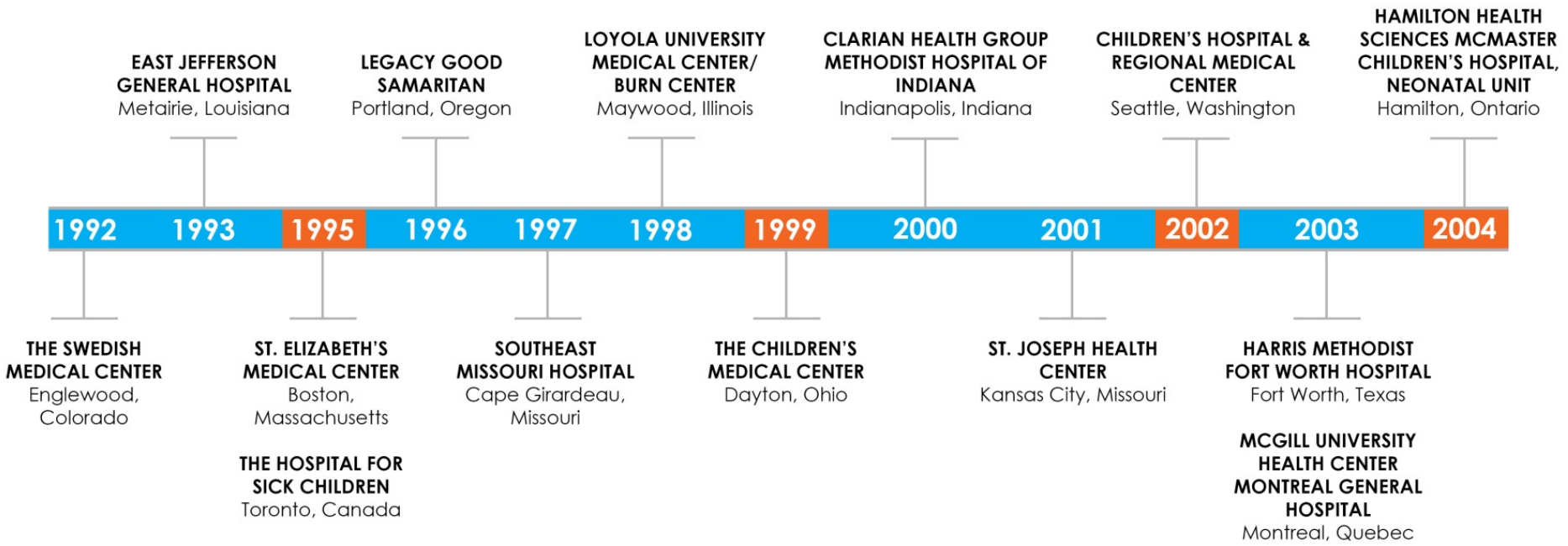
Key Words: architecture; constr… design; environment; healing; inte…

2013 Society of Critical Care Medicine Section Award Winner for Published Guidelines

Guidelines for Intensive Care Unit Design. ICU Design Guidelines Task Force, Committee of the American College of Critical Care Medicine, Society of Critical Care Medicine. Critical Care Medicine 2012 May;40(5):1586-600.

ICU Citation Winners

25 Years of Winning Designs

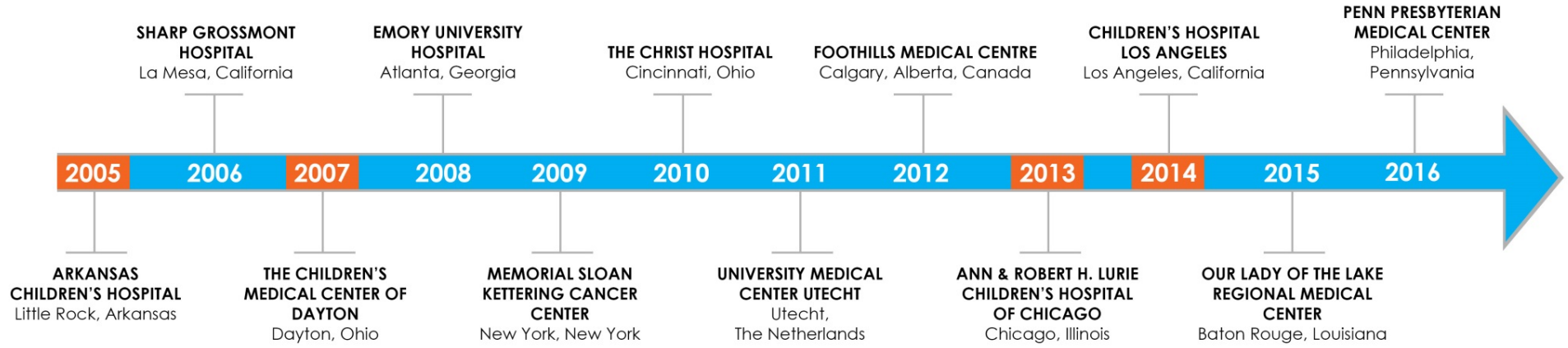


ADULT

PEDIATRIC

ICU Citation Winners

25 Years of Winning Designs



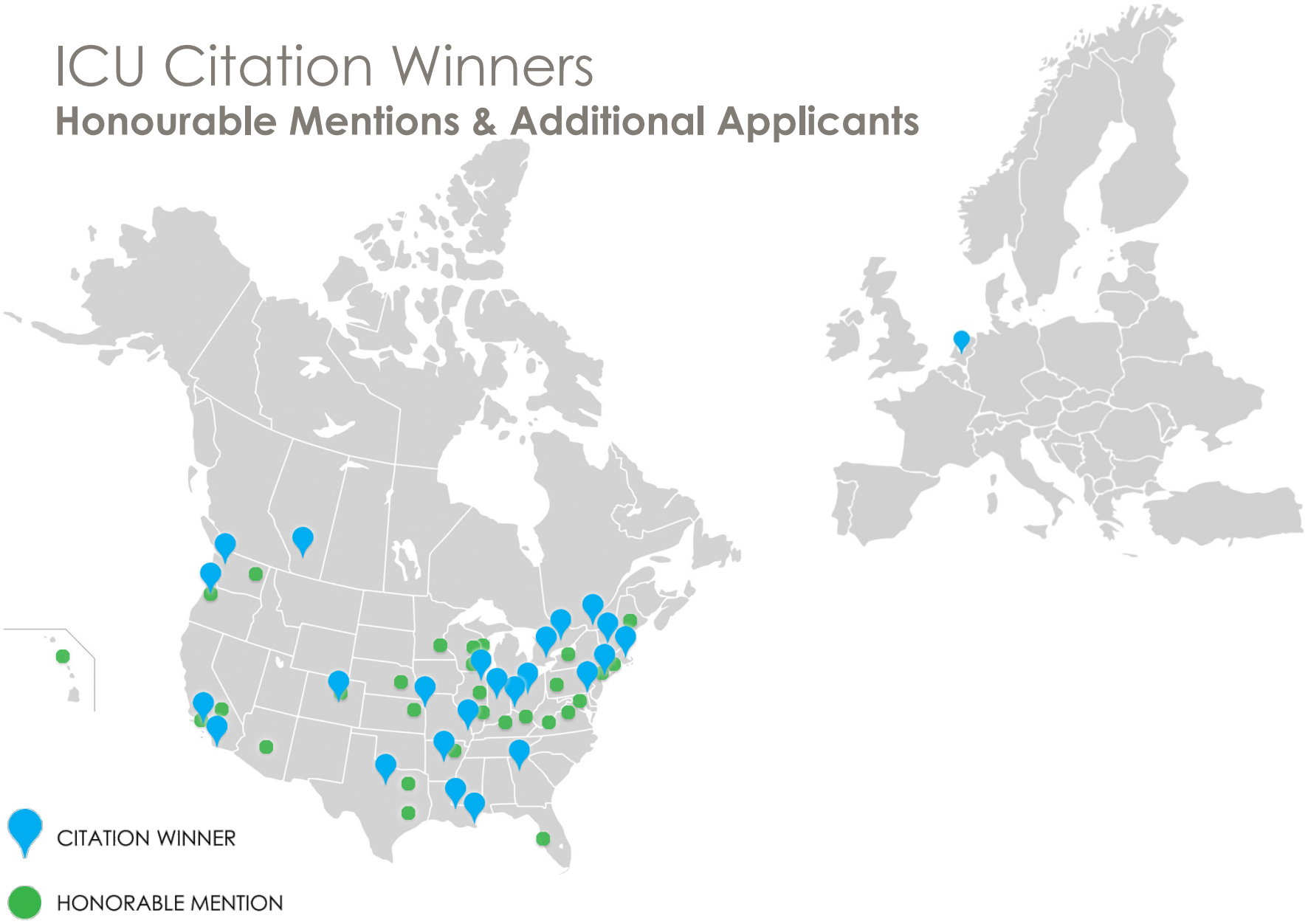
2016 ICU Design Competition Winner
Penn Presbyterian Medical Center
Philadelphia, Pennsylvania, USA

ICU Citation Winners

Honourable Mentions & Additional Applicants

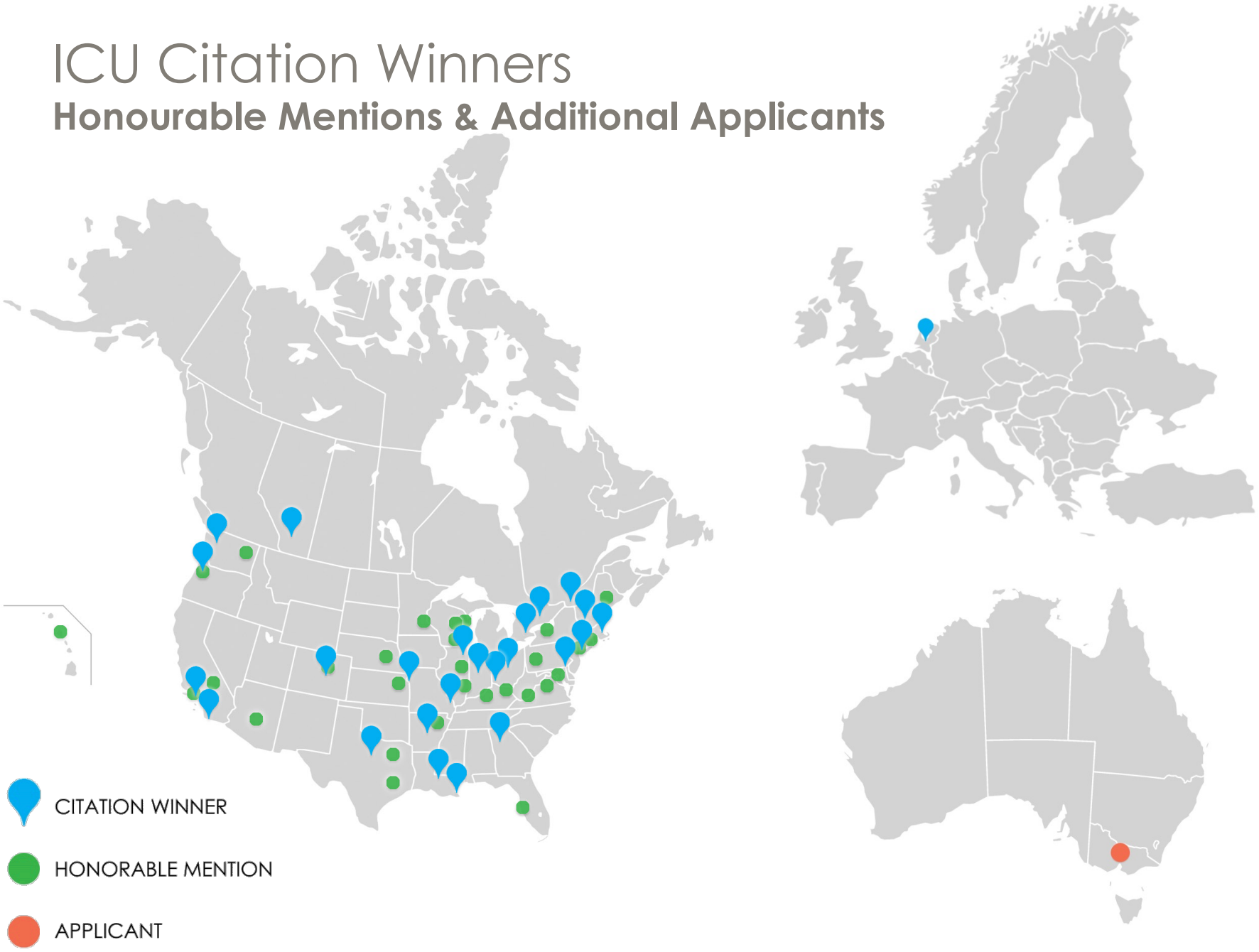
ICU Citation Winners

Honourable Mentions & Additional Applicants



ICU Citation Winners

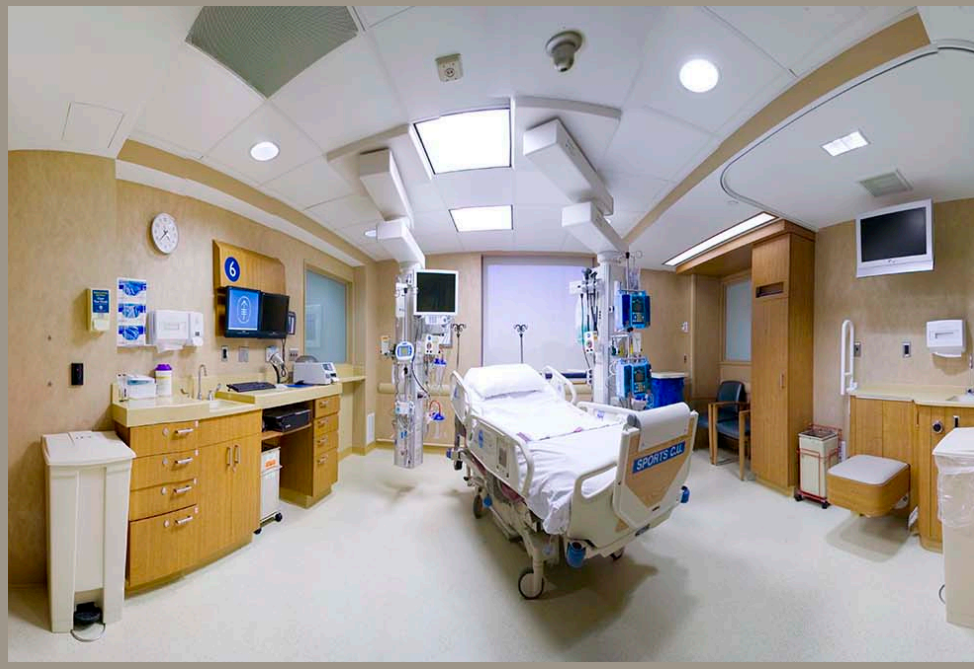
Honourable Mentions & Additional Applicants



SCCM - ICU Design Competition

25 Years of Winning Designs

1992 ICU Design Competition Winner
The Swedish Medical Center
Englewood, Colorado, USA



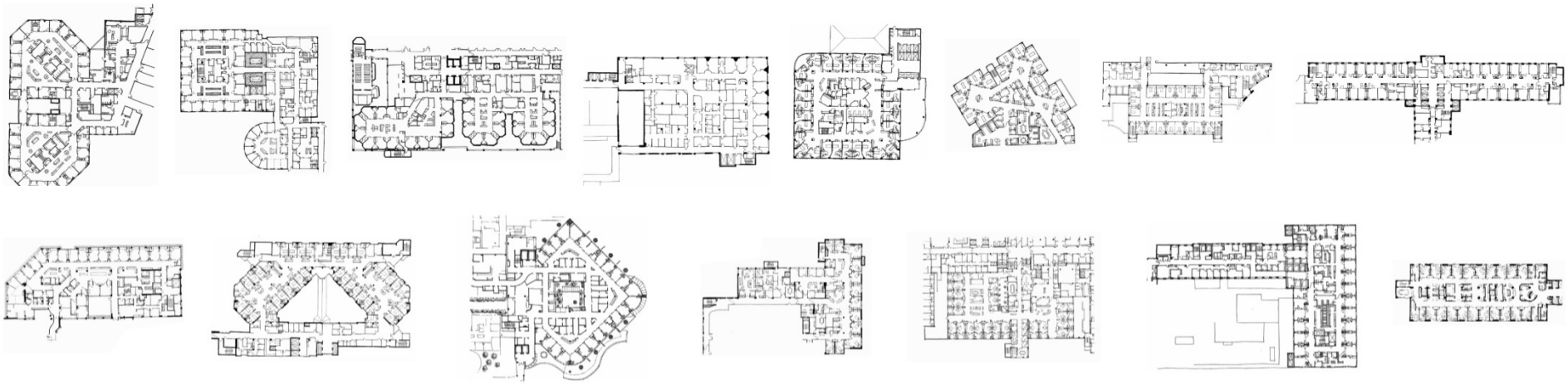
2009 ICU Design Competition Winner
Memorial Sloan-Kettering Cancer Center
New York City, New York, USA

SCCM - 2011 Winning ICU Design Video

Utrecht Medical Center, The Netherlands

Critical Care Units – Trends in Winning Designs

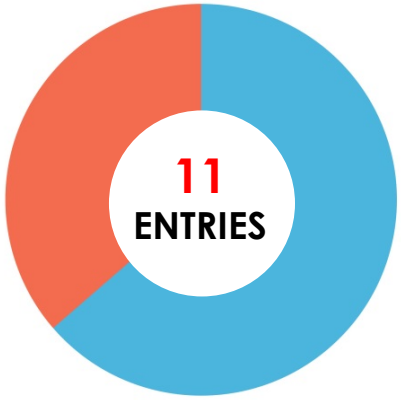
2009 World Health Design



Cadenhead CD, Anderson DC. Critical Care Unit Design, The Winners and Future Trends: An Investigative Study. World Health Design 2009;2(3):72-77.

2013-2016 ICU Citation Winners

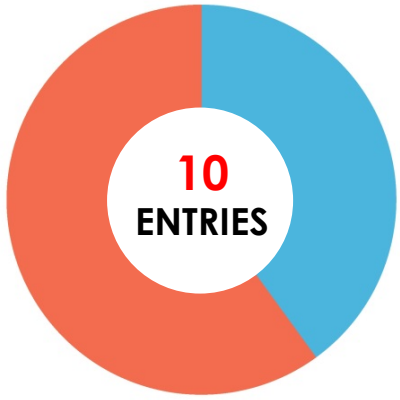
New Construction versus Renovation



2013

2014

2015



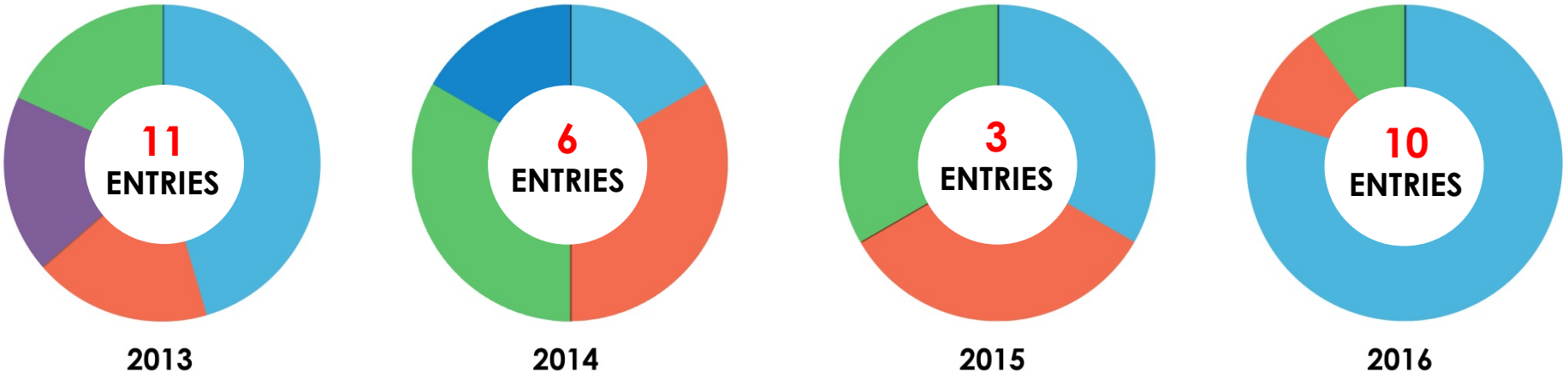
2016

RENOVATION

NEW CONSTRUCTION

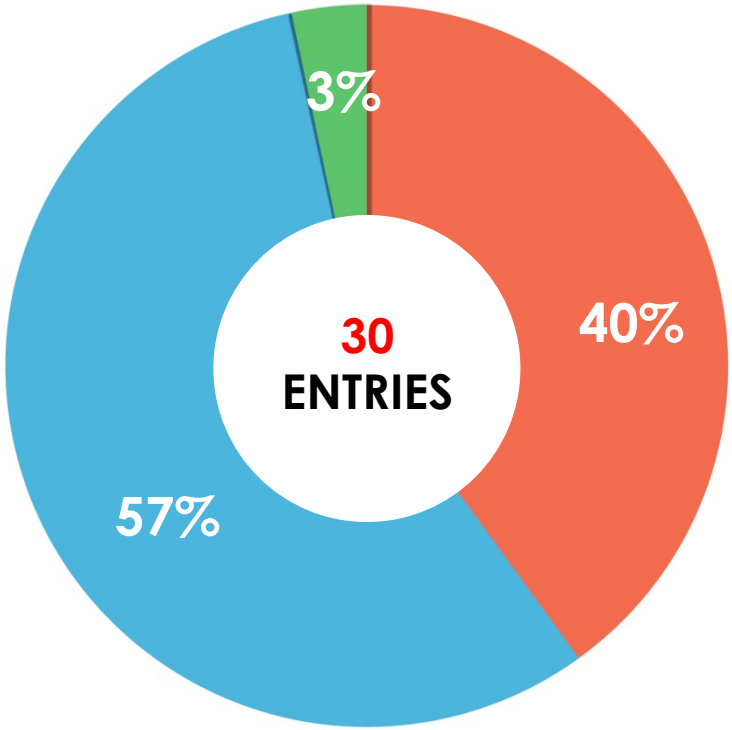
2013-2016 ICU Citation Winners

Unit Typologies

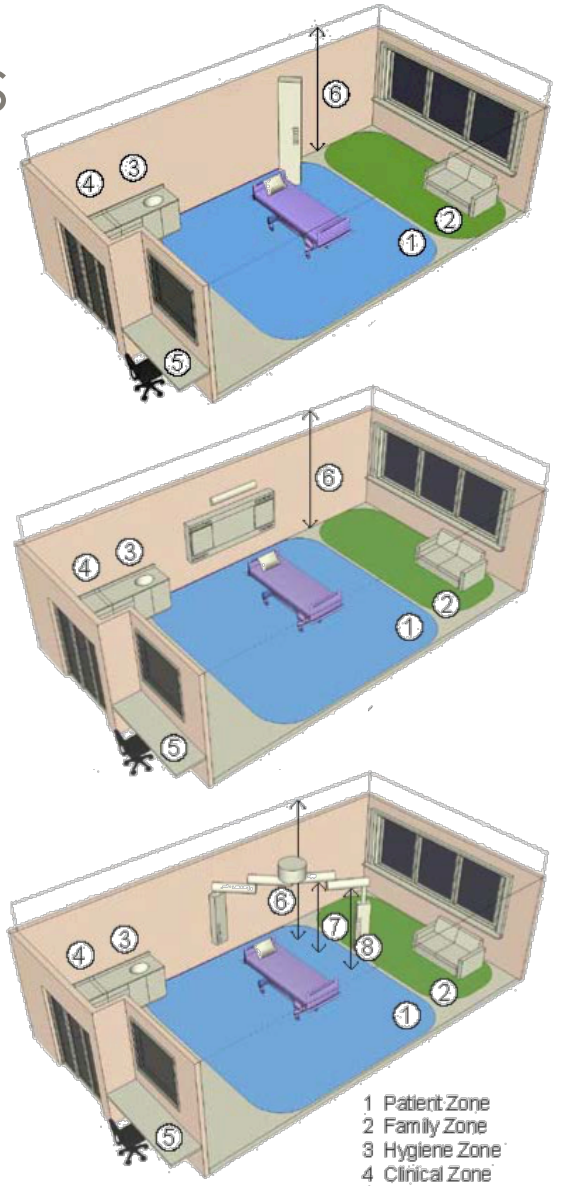


2013-2016 ICU Citation Winners

Life Support Systems



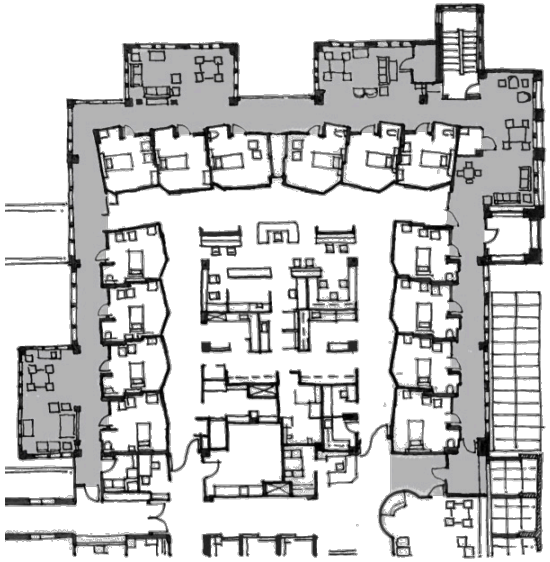
BOOM
HEADWALL
POWER COLUMN

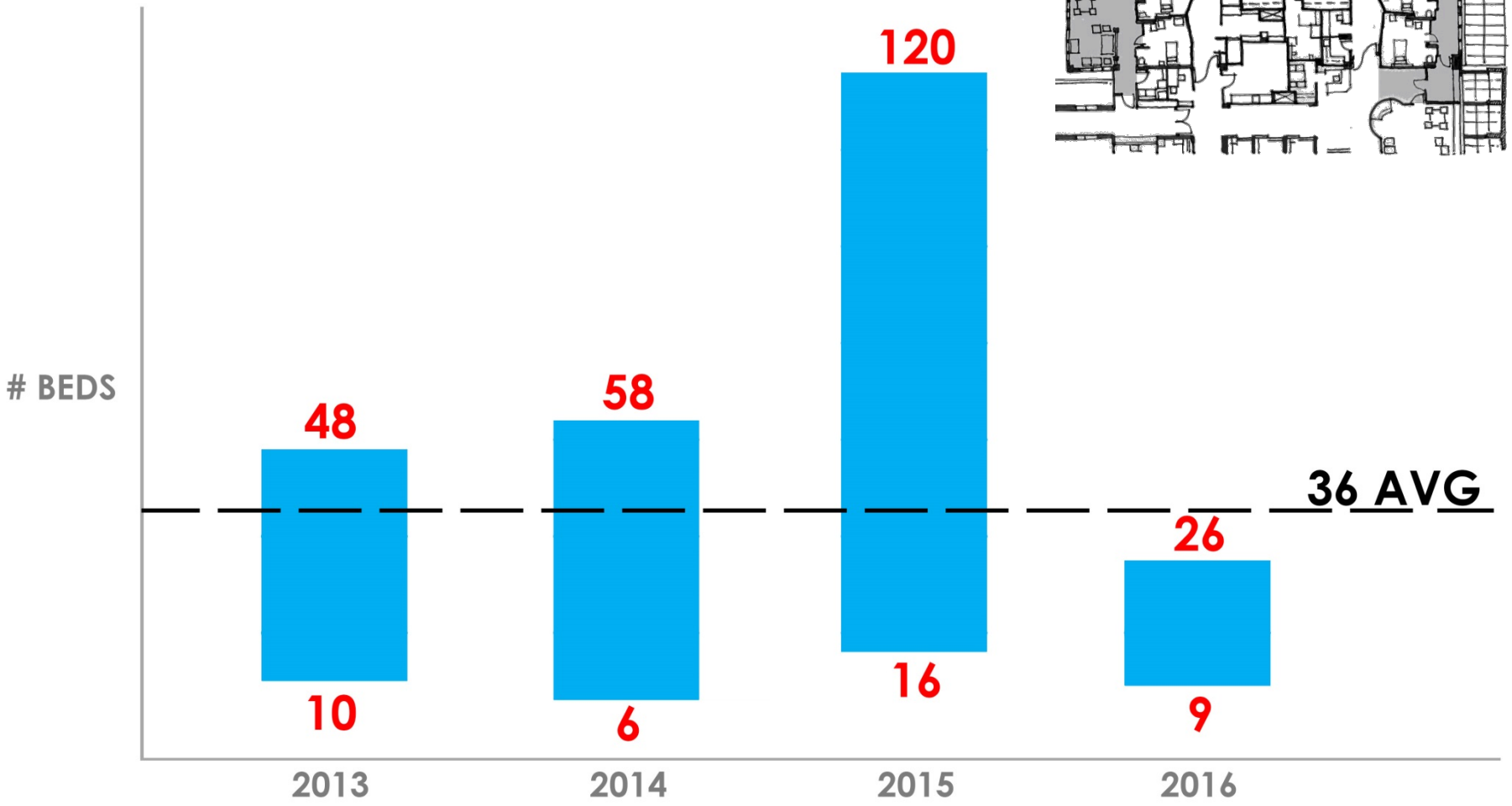


1 Patient Zone
2 Family Zone
3 Hygiene Zone
4 Clinical Zone
5 Charting Sub-Station
6 Ceiling Height: 9' to 11' (2.7m to 3.3m)
7 Clearance: 8' to 10' (2.4m to 3.0m)
8 Clearance: 7' to 9' (2.1m to 2.7m)

2013-2016 ICU Citation Winners

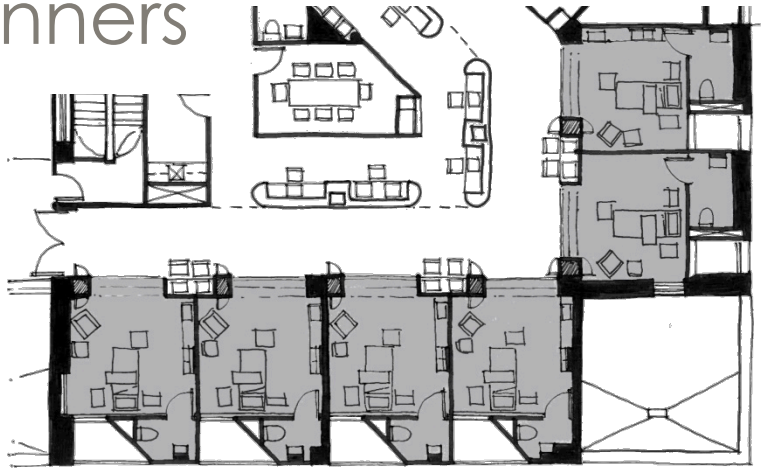
Overall Unit Size

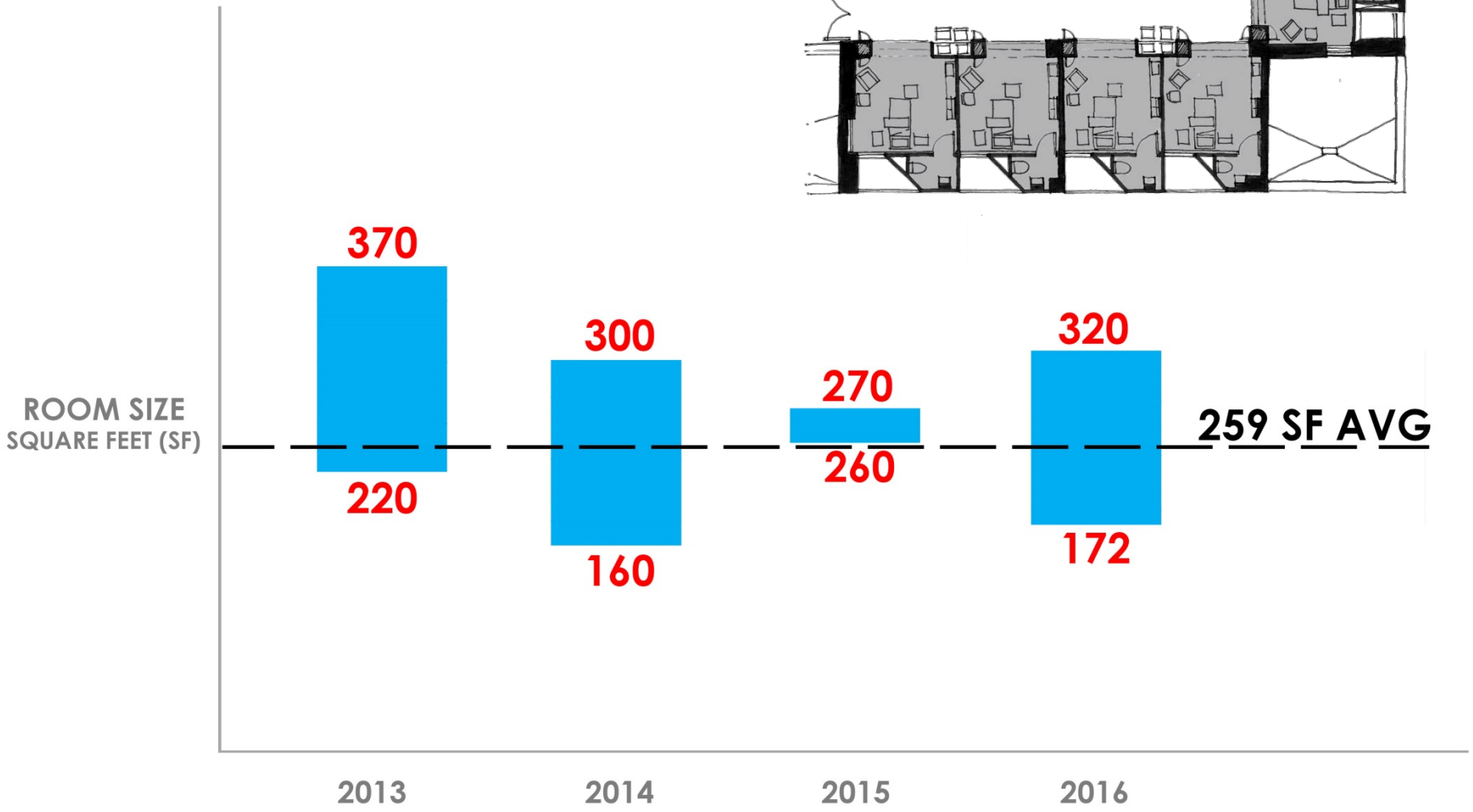




2013-2016 ICU Citation Winners

Patient Room Size

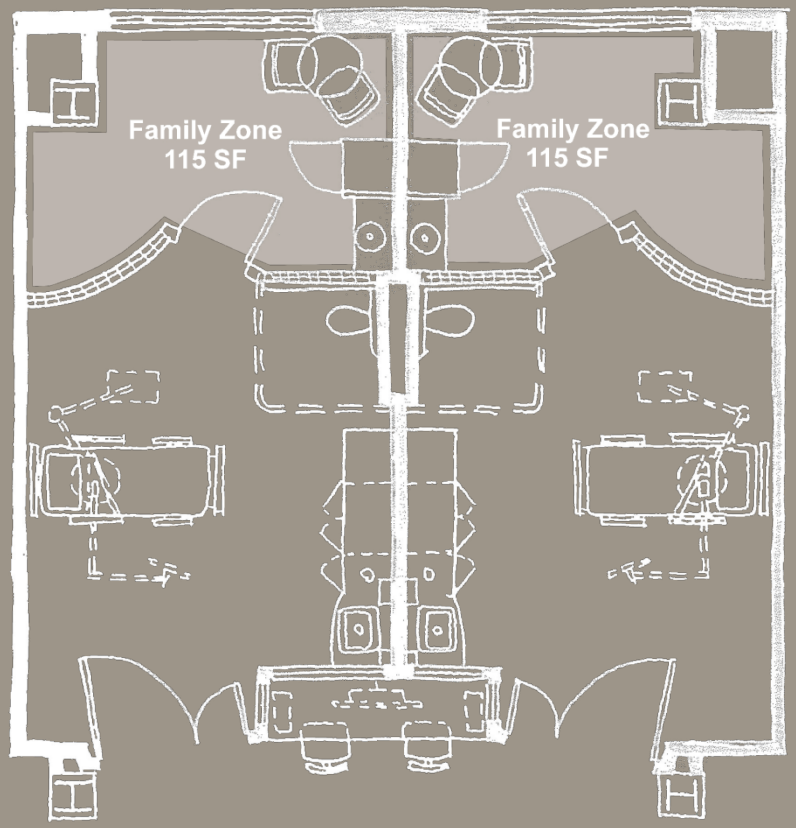




Intensive Care Unit Design

Future Trends

1. Larger Units
2. Patient Rooms
3. Staff Environment
4. Technology
5. Changing Practices



2008 ICU Design Competition Winner
Emory University Hospital
Atlanta, Georgia, USA

Intensive Care Unit Design

25 Years of Winning Trends

European Healthcare Design Congress
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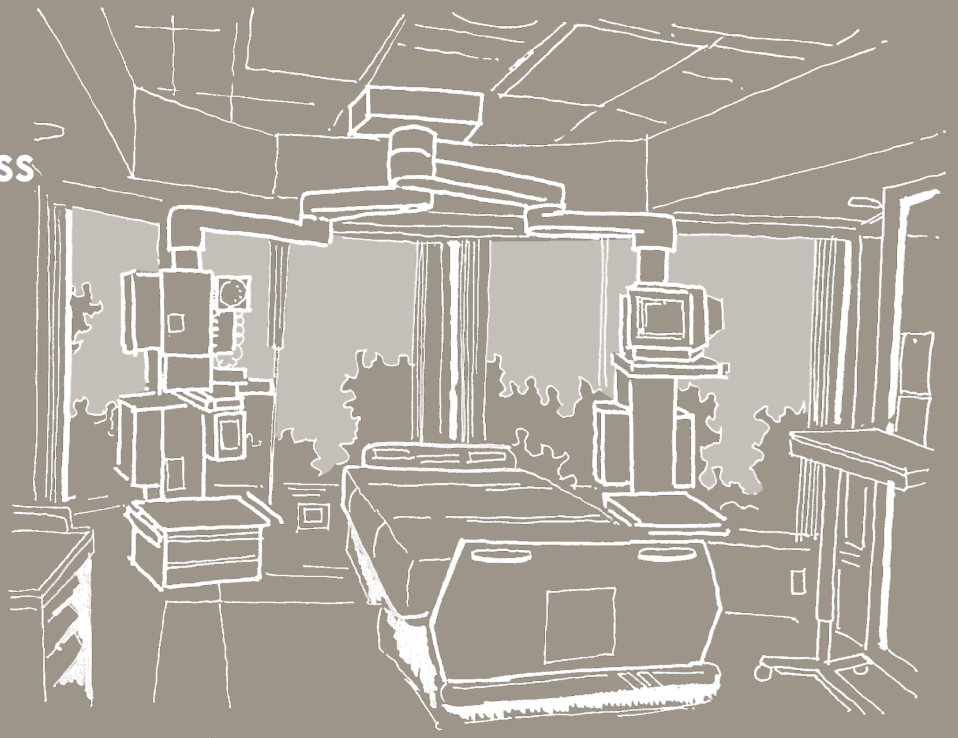
http://www.sccm.org



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Critical care design of tomorrow: how technology fits in

Neil A Halpern MD, MCCM, FCCP, FACP
Chief Critical Care Medicine
Memorial Sloan Kettering Cancer Center, NYC

Agenda

Medical devices

Cybersecurity

IT Sim Lab

Dark data & future proofing

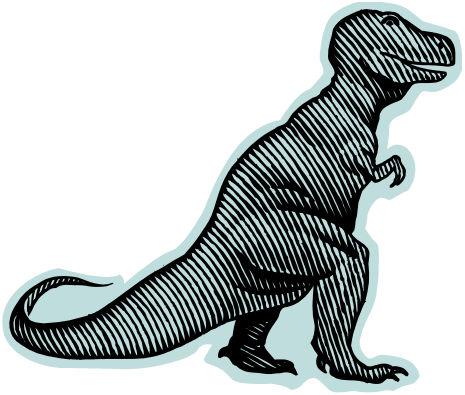
Medical devices

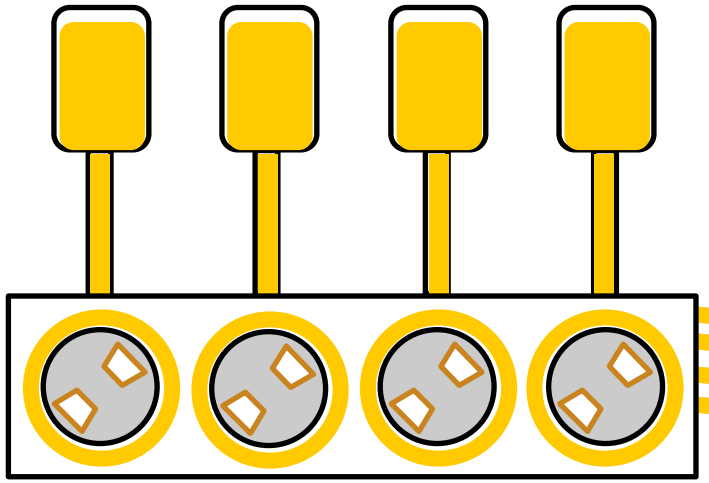
Past: medical devices were just devices with defined tasks

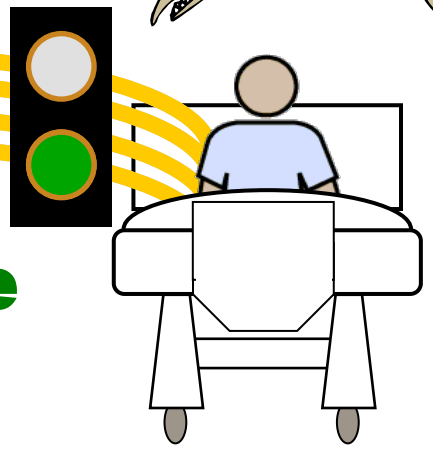
- Physiological monitor - counted heart beats
- Mechanical ventilator - pushed air
- Infusion pump - pumped fluid

Now: medical devices are complicated, sophisticated, costly, informatics platforms

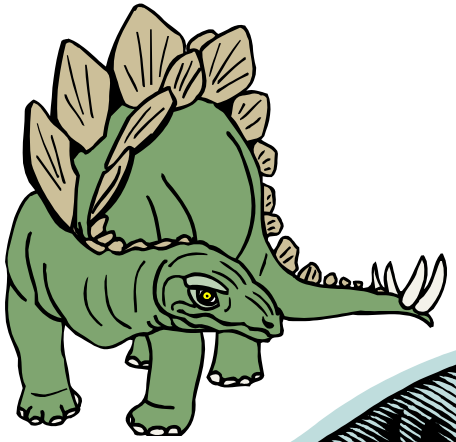
Infusion Pump: The Dark Ages

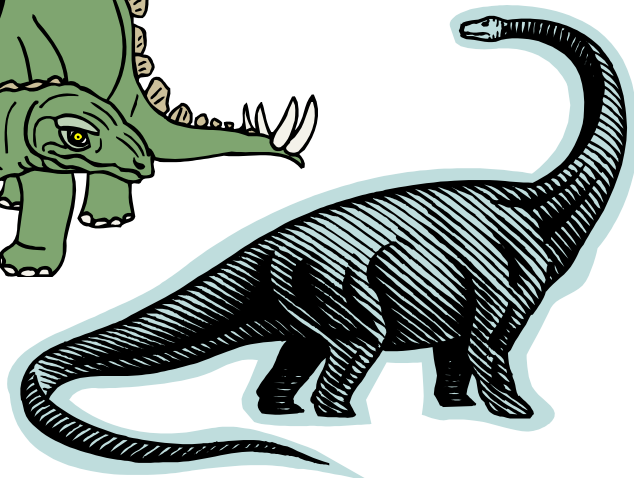


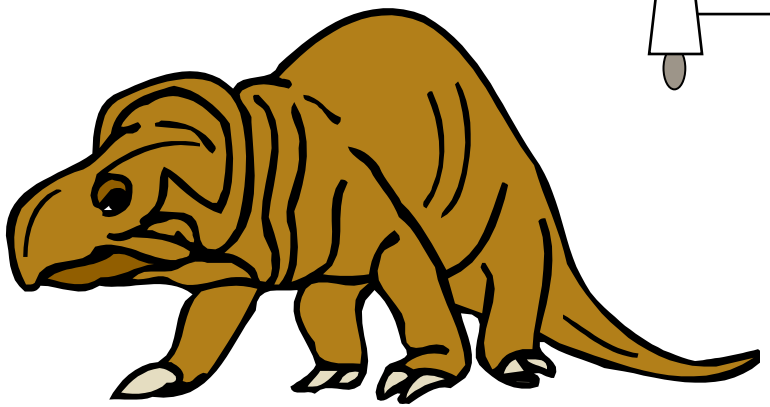




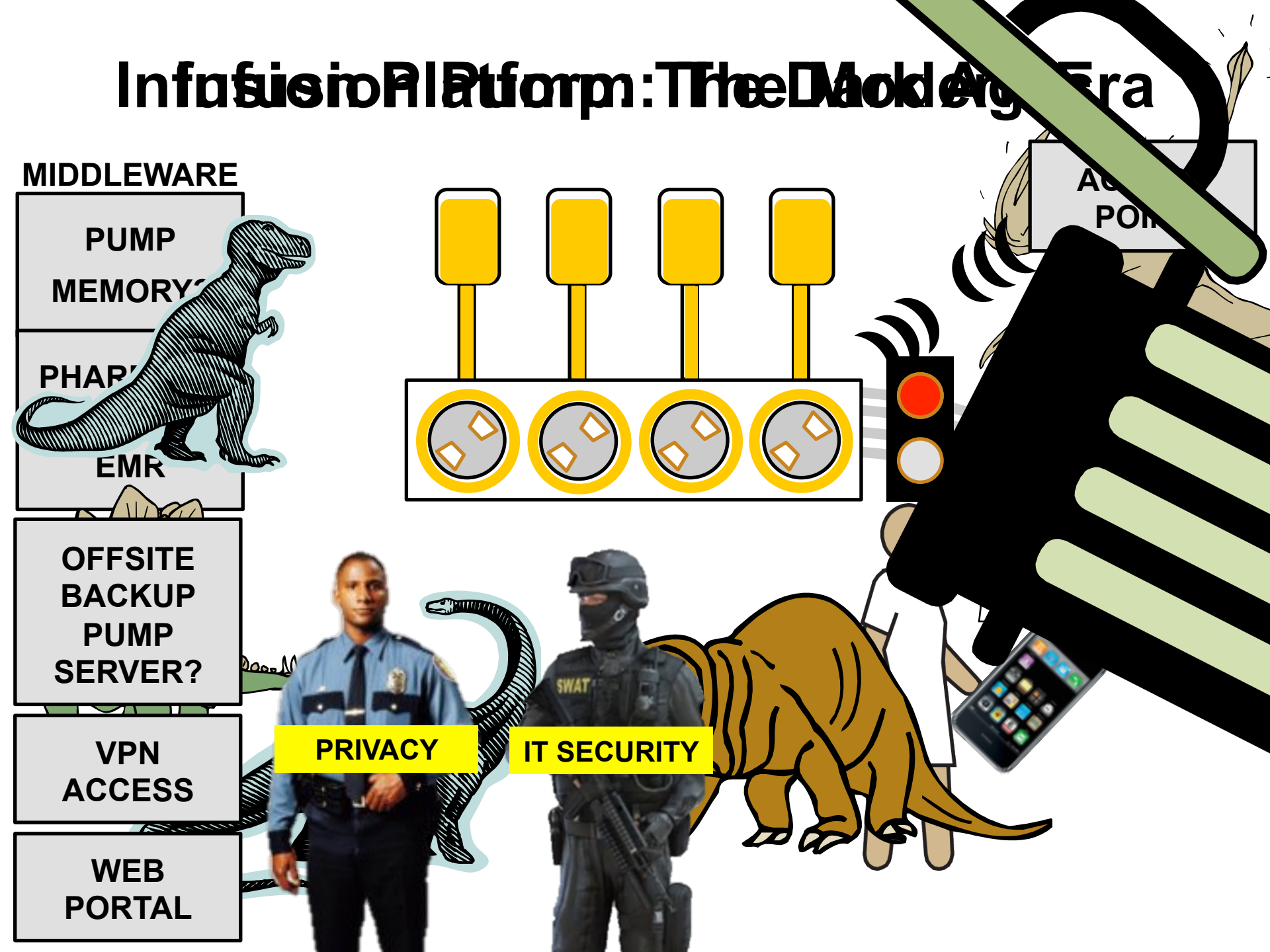
One-time Purchase





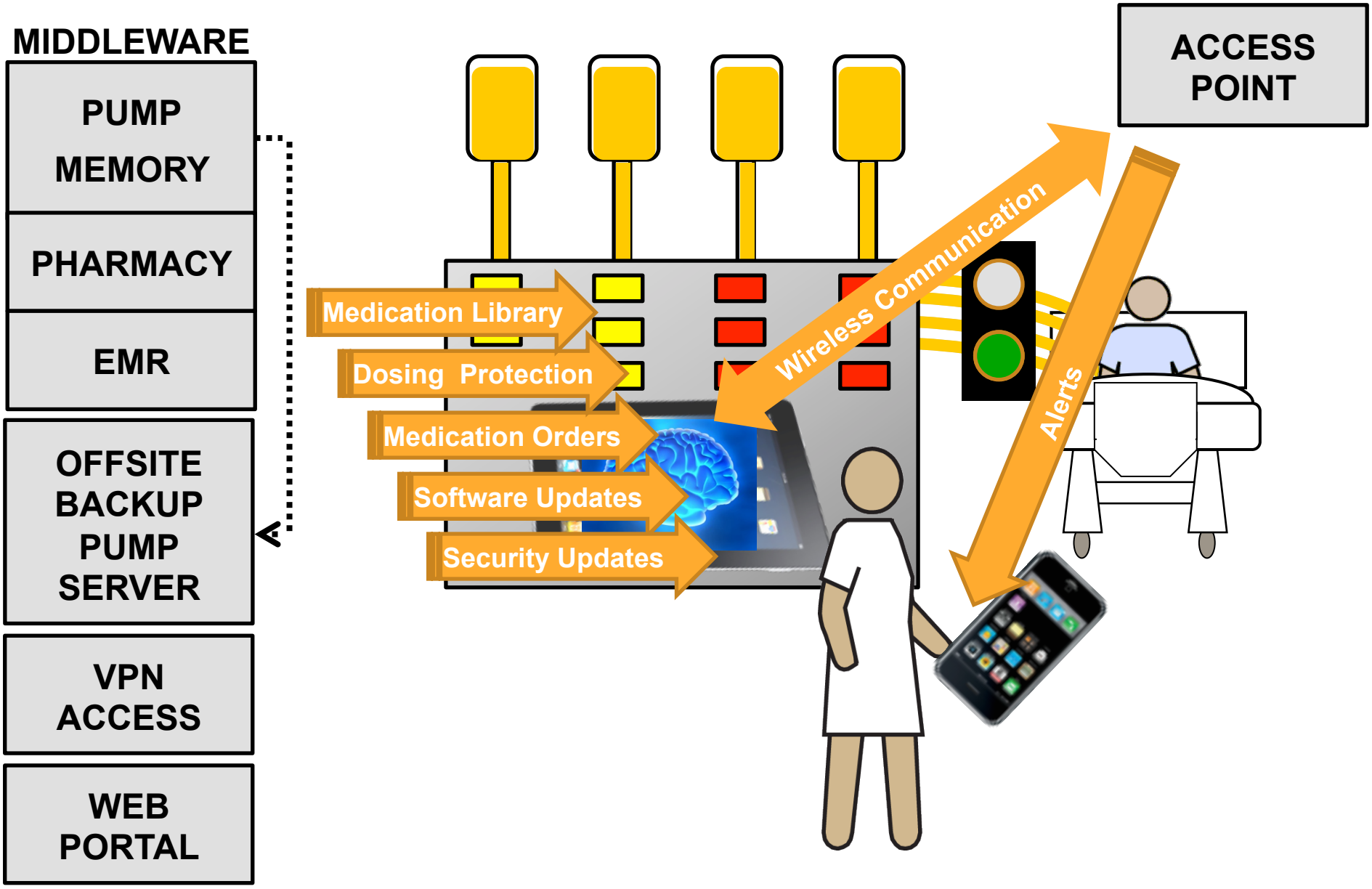


Infusion Platform: The Modern Era



Implementing Infusion Pump System

Infusion Platform: The Modern Era

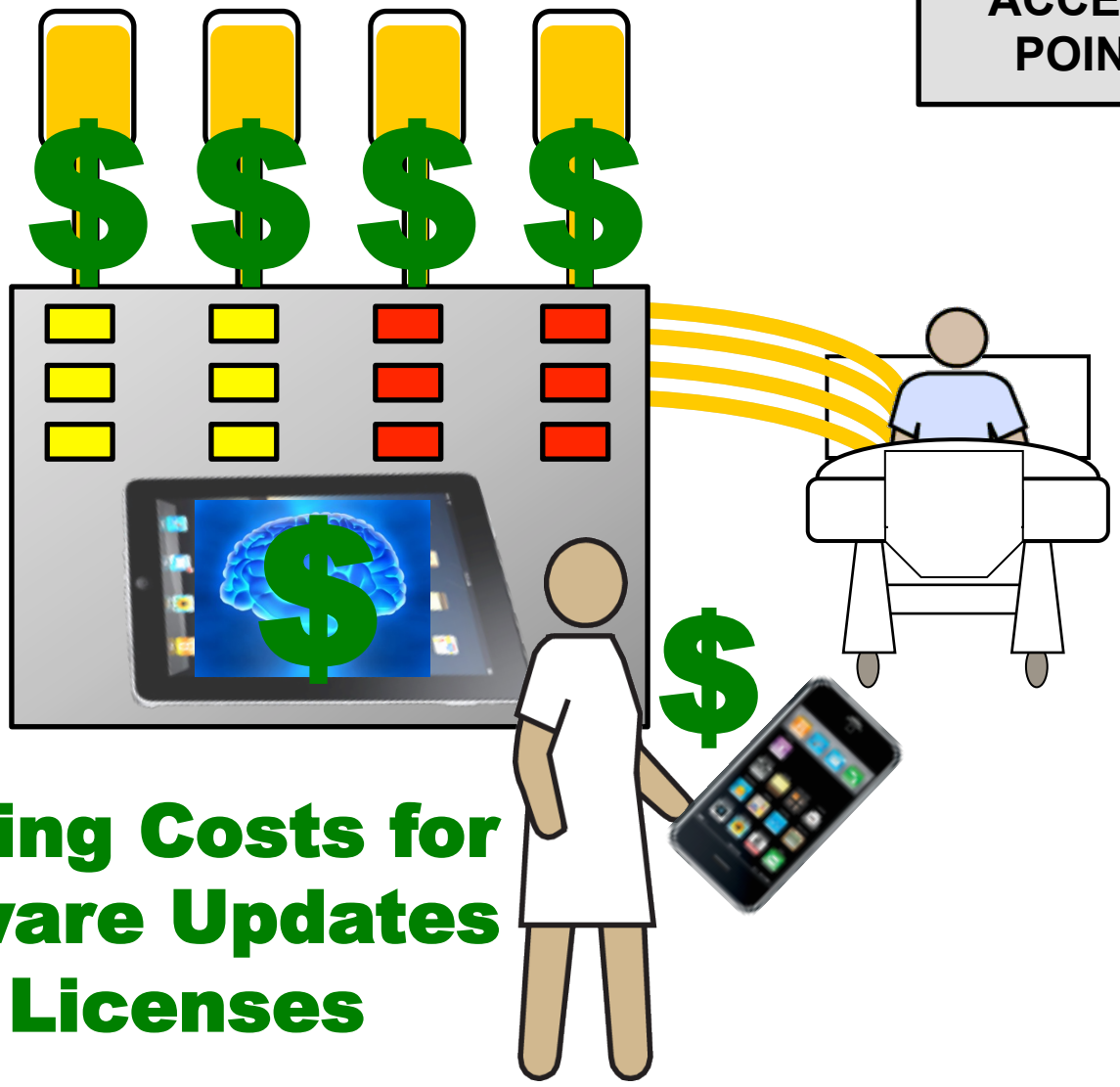


$$$ Infusion Platform: Costs

MIDDLEWARE

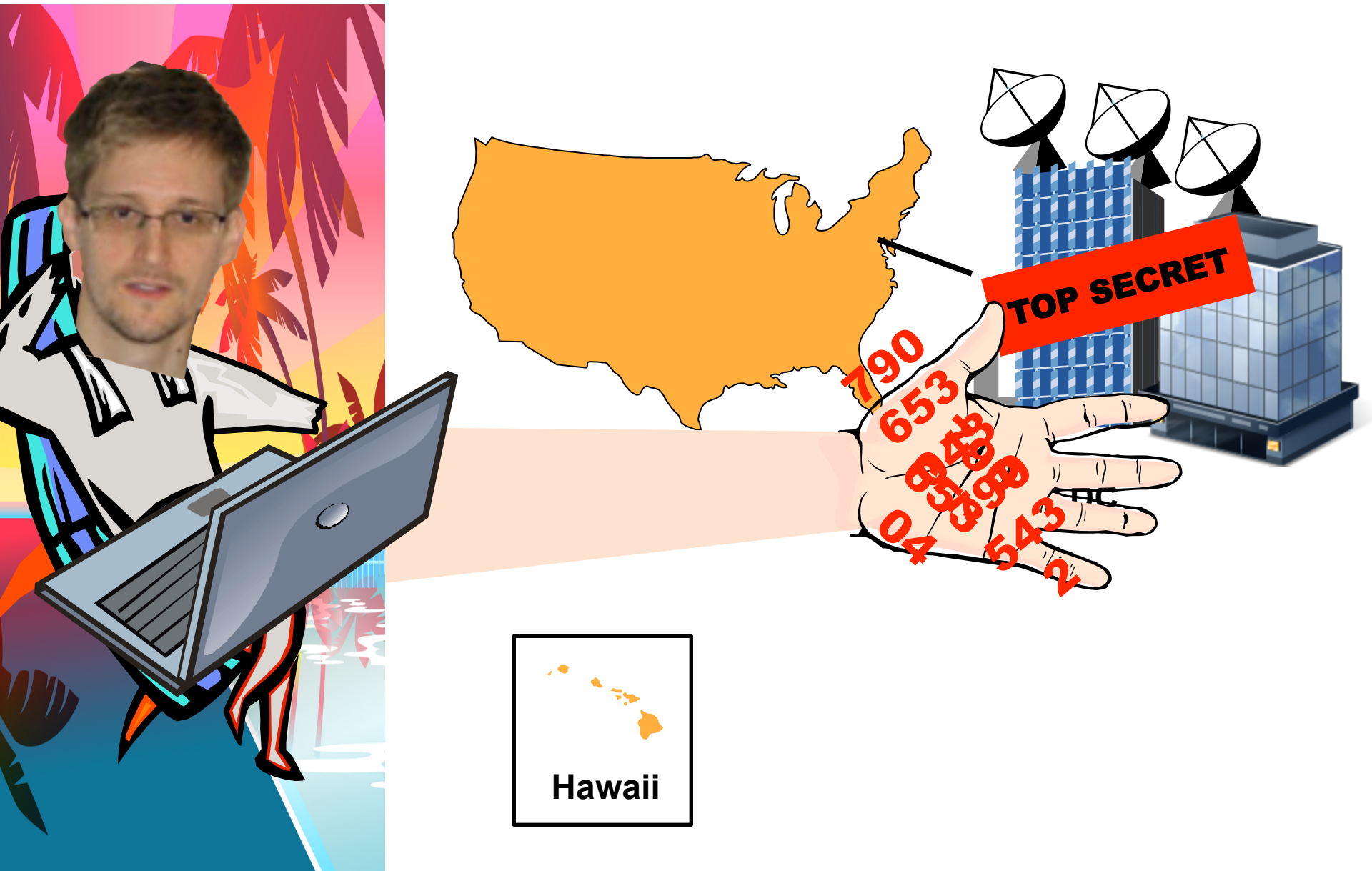
- PUMP MEMORY
- PHARMACY
- EMR
- OFFSITE BACKUP PUMP SERVER
- VPN ACCESS
- WEB PORTAL

ACCESS POINT



Ongoing Costs for Software Updates & Licenses

Cybersecurity: Real or a Joke?



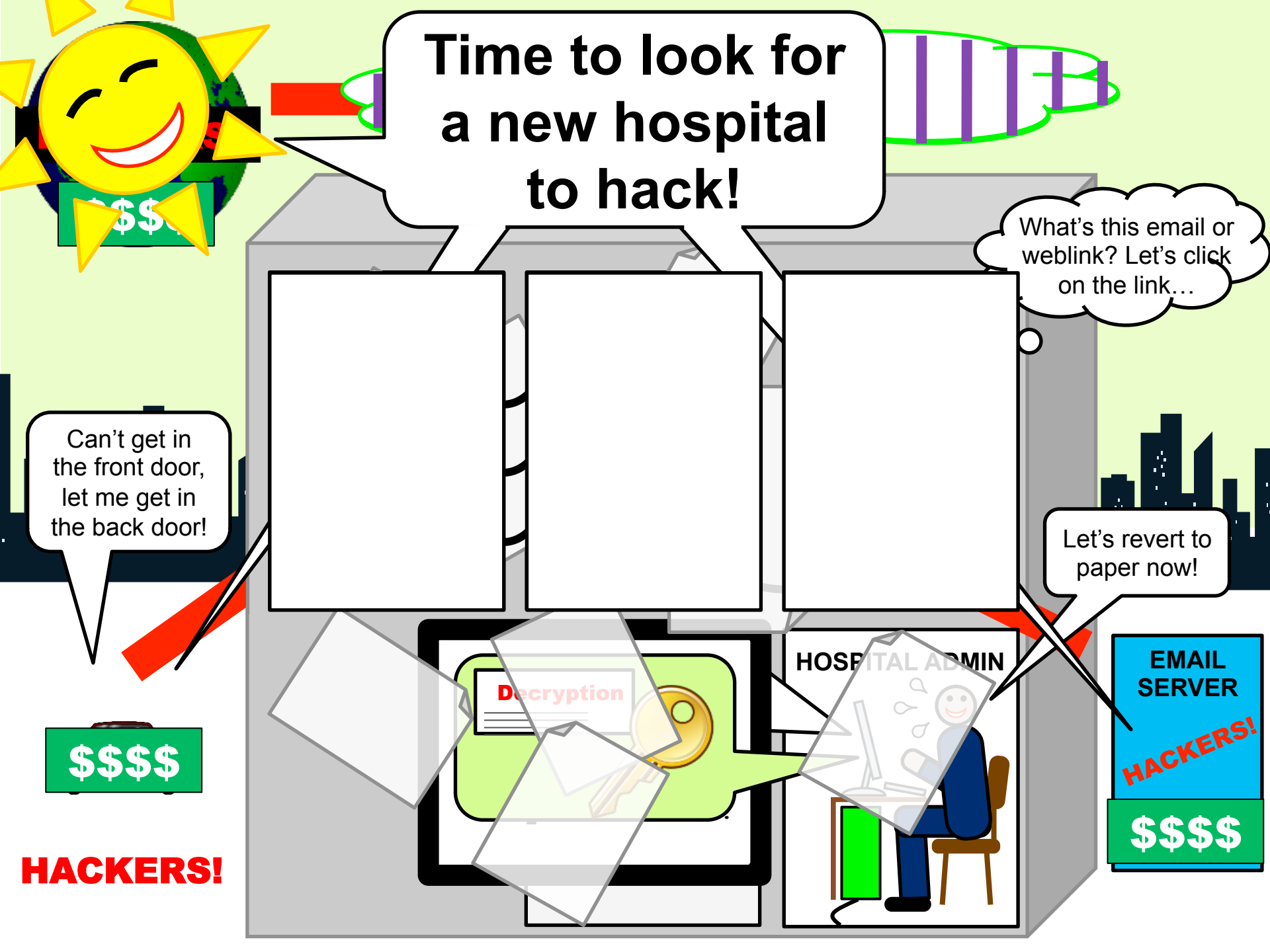
YAHOO!
TARGET
Neiman Marcus
DIRECT
43790

Hospital hacker attacks

Historically: Obtain pt records for fraud schemes

Current: Digital extortion racket

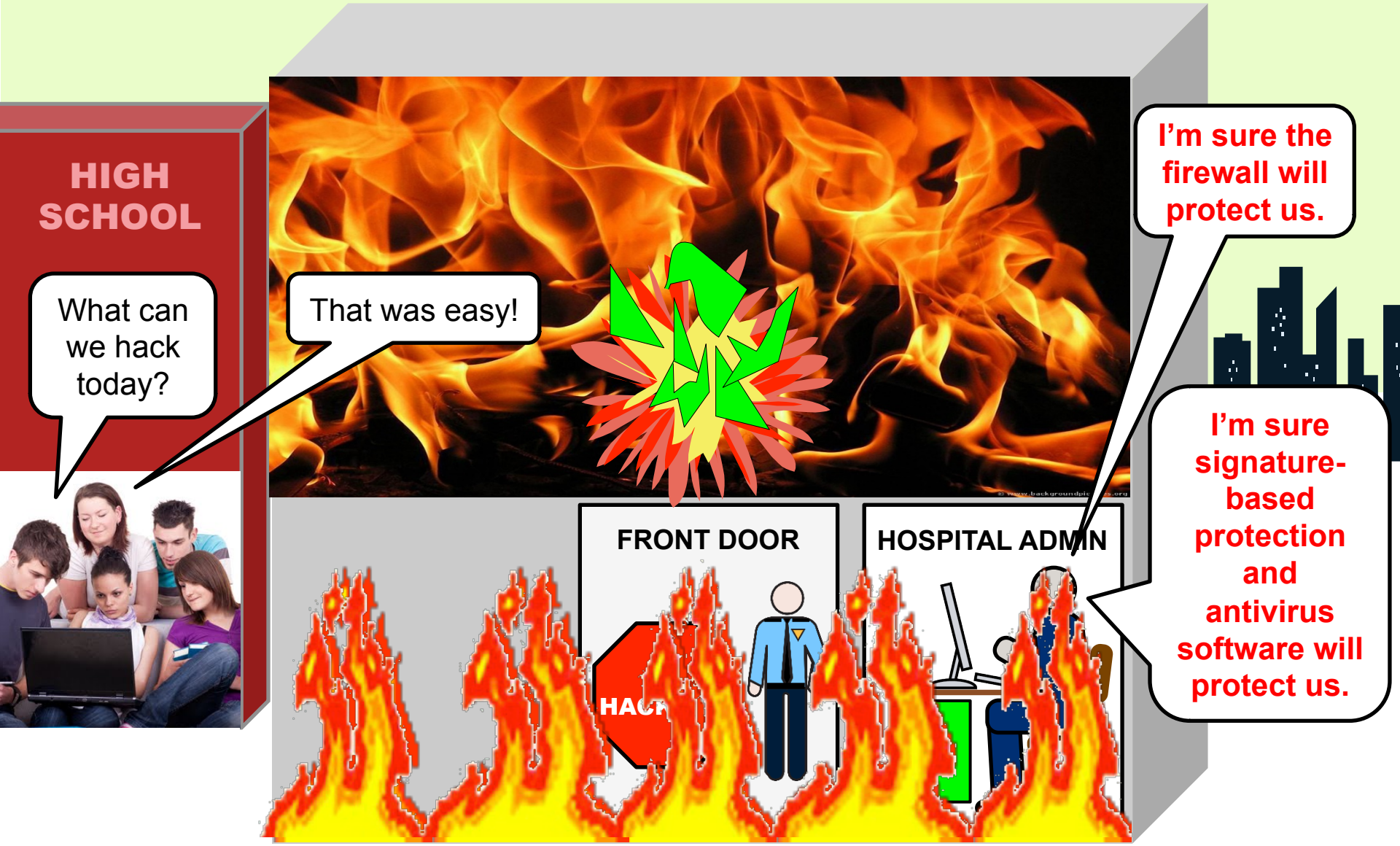
- Paralyze the hospital
- Demand economical ransom


Time to look for a new hospital to hack!
What's this email or weblink? Let's click on the link…
Can't get in the front door, let me get in the back door!
Let's revert to paper now!
$$$$
HACKERS!
Decryption
HOSPITAL ADMIN
EMAIL SERVER
HACKERS!
$$$$

Recently Hacked US Hospitals

- Hollywood Presbyterian, LA; single stand alone
  - Paid 17G in Bitcoin
- Methodist Hospital, Henderson, KY
  - Restored data from back-ups/paid 18G
- MedStar Health System, Columbia, MD, 10 hospitals
  - $18,500 to restore system

Basic hospital IT protection



Why MEDJACK/Hack medical devices?

Medical devices:

- Connected to hospital network
- "Black boxes" to the hospital
- Not amenable to common cyber defenses
- No one knows when infected

Med device companies:

- Not trained or skilled to handle complex CS issu
- Devices run out of date & insecure OS

TrapX Security (www.trapx.com)

recreated recent attacks in Sim lab

- Studied: Infusion pumps, PACS, POCT analyzers
- Easily hacked & data manipulated

Authored By: TrapX Labs - A Division of TrapX Security, Inc.
Date: May 7, 2015

FDA Cybersecurity Guidelines

Dating back to 2007, most current…

Draft Guidance for Industry. "Moving Forward: Collaborative Approaches to Medical Device Cybersecurity"

Distributed for comment. Jan 22, 2016, *Federal Register, Vol 81, Issue 14*

Annual FDA Cybersecurity Guidelines for Medical Devices

- Challenging to address CS threats
- Cannot completely eliminate them
- Shared responsibilities between manufacturers & hospitals to be vigilant in assessing threats, risk levels & mitigating them
- Hospitals to evaluate & protect their networks
- FDA does NOT need to typically review/ approve medical device CS software changes

What can a hospital or device company do?

Wake up, make CS a priority

Recognize CS failure is a pt care issue

Evaluate existing & new systems

Don't try and monitor yourself

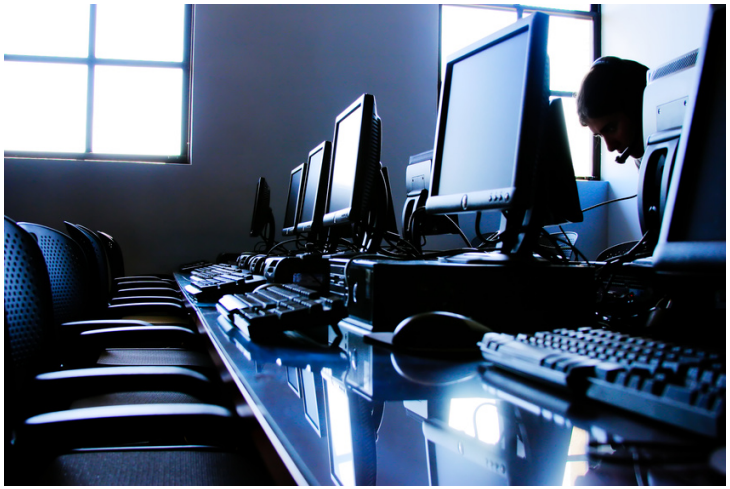
- Hire chief information security officer
- 24/7 external security operations center to monitor hospital

Build an ITSim Lab

With identical systems as ICU & hospital

Obtain & test ALL prioritized technologies (new devices, Apps & upgrades) in real-life settings

- Function, connectivity,
- Interoperability & security



Dark Data & Future Proofing

Conclusions

- Appreciate the integral role IT plays in the ICU design of tomorrow
- Recognize that medical devices are informatics platforms
- Prioritize cybersecurity
- Test everything in an ITSim Lab
- Cautiously embrace the IT future

Thank You!

ntec