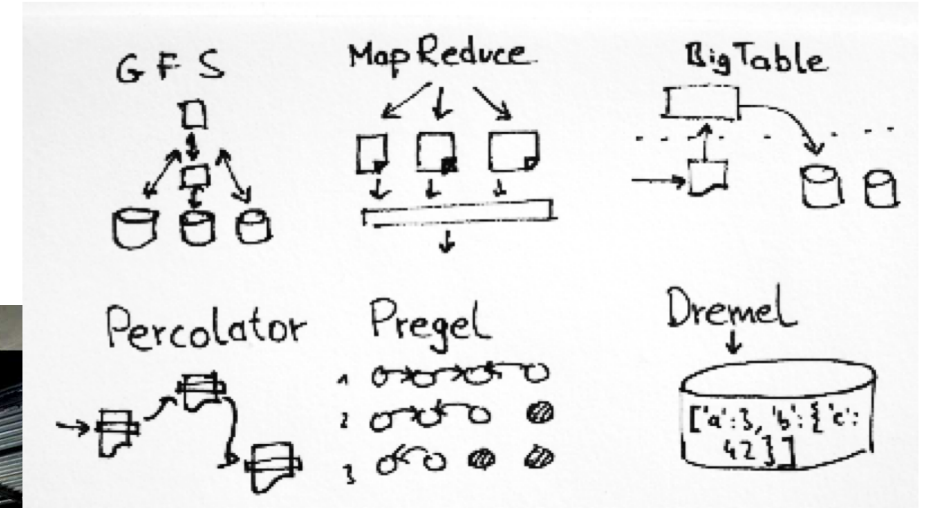# Everything breaks
All the time

Intro

- After IT related jobs;
- Dutch Police – enterprise IT
- OCOM group - hosting & cloud
- SDL – Software As A Service
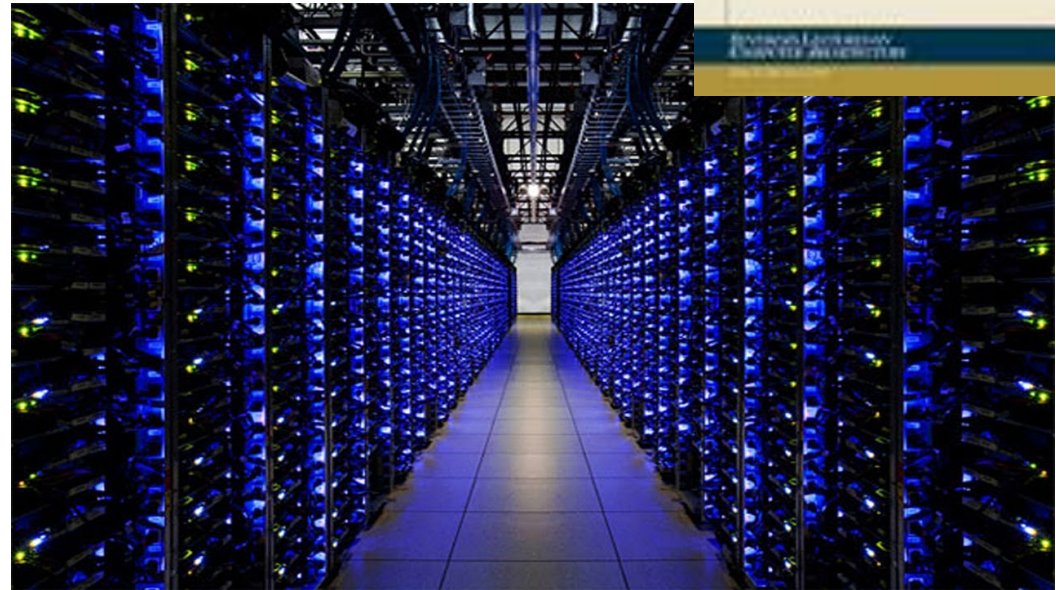- Spoken Communications – Call Center as Service

History of Cloud backend

- Behind the Website and Apps;
- Running in to scale problems
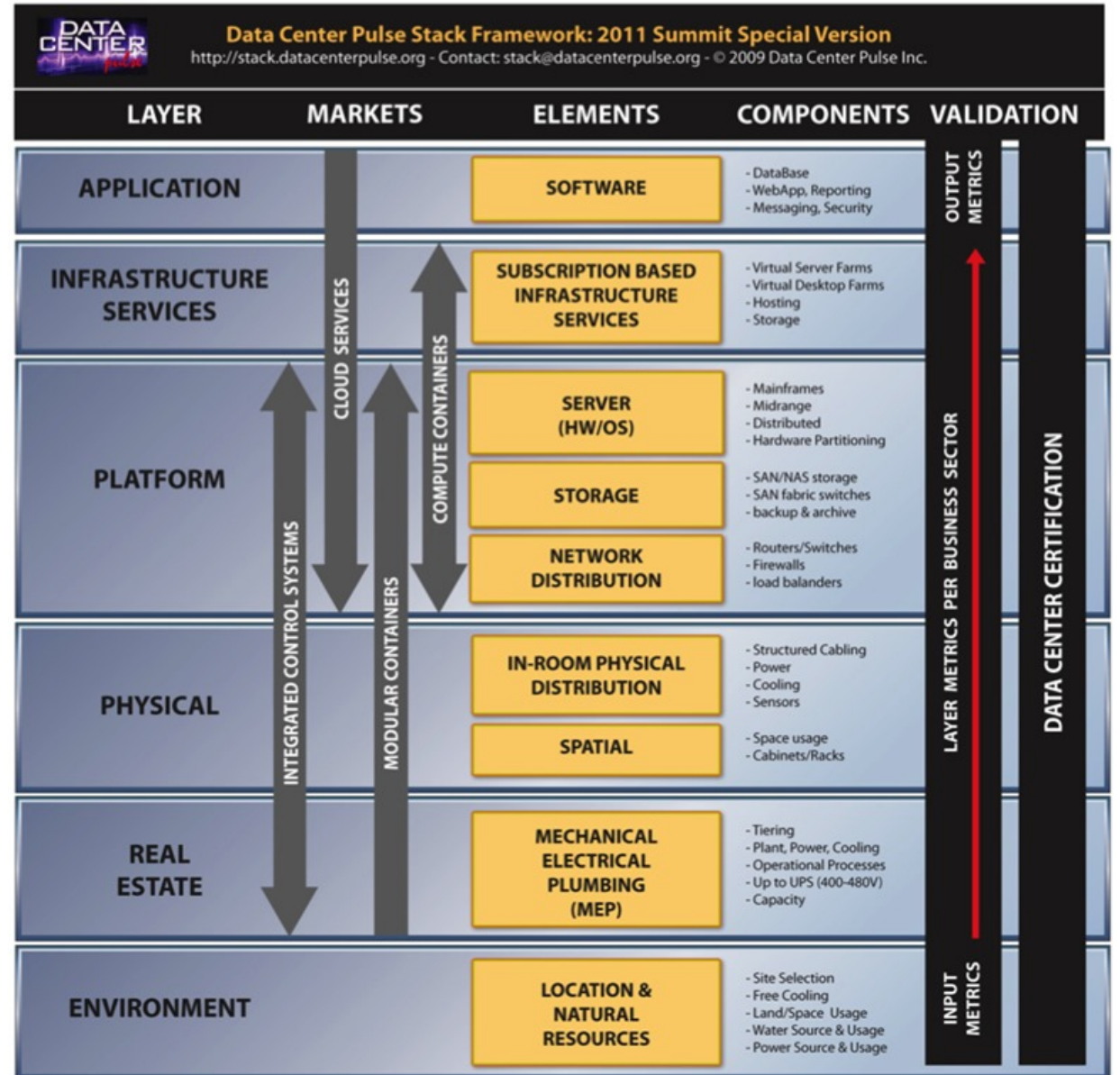 - Cost
  - Complexity
  - Speed

Running at scale

- The 'normal' things didn't work any more.
- New server hardware, networking, software
- New datacenters
- New economics

The Datacenter as a Computer
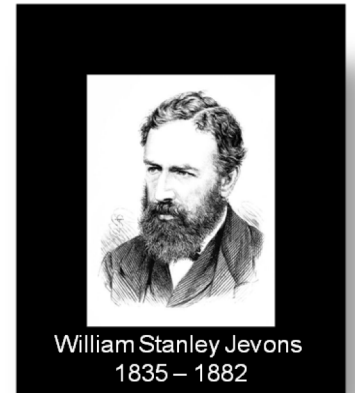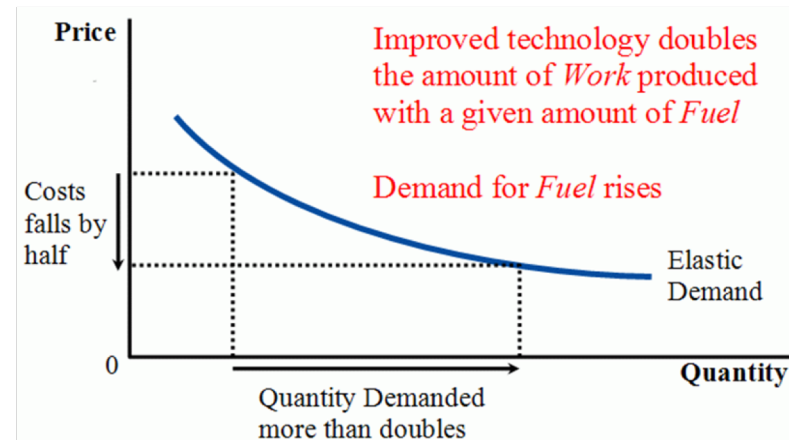
An Introduction to the Design of Warehouse-Scale Machines

Running at scale

- Many layers, abstracted away

Data Center Pulse Stack Framework: 2011 Summit Special Version
http://stack.datacenterpulse.org - Contact: stack@datacenterpulse.org - © 2009 Data Center Pulse Inc.

LAYER	MARKETS	ELEMENTS	COMPONENTS	VALIDATION
APPLICATION		SOFTWARE	- DataBase - WebApp, Reporting - Messaging, Security	
INFRASTRUCTURE SERVICES	Cloud Services	SUBSCRIPTION BASED INFRASTRUCTURE SERVICES	- Virtual Server Farms - Virtual Desktop Farms - Hosting - Storage	
PLATFORM	Compute Containers	SERVER (HW/OS)	- Mainframes - Midrange - Distributed - Hardware Partitioning	
		STORAGE	- SAN/NAS storage - SAN fabric switches - backup & archive	
		NETWORK DISTRIBUTION	- Routers/Switches - Firewalls - load balanders	
PHYSICAL	Integrated Control Systems / Modular Containers	IN-ROOM PHYSICAL DISTRIBUTION	- Structured Cabling - Power - Cooling - Sensors	
		SPATIAL	- Space usage - Cabinets/Racks	
REAL ESTATE		MECHANICAL ELECTRICAL PLUMBING (MEP)	- Tiering - Plant, Power, Cooling - Operational Processes - Up to UPS (400-480V) - Capacity	
ENVIRONMENT		LOCATION & NATURAL RESOURCES	- Site Selection - Free Cooling - Land/Space Usage - Water Source & Usage - Power Source & Usage	OUTPUT METRICS / INPUT METRICS / LAYER METRICS PER BUSINESS SECTOR / DATA CENTER CERTIFICATION

Large scale – everybody's problem now

- For cloud providers – millions of servers
- For cloud costumers – millions of instances

Jevons Paradox will apply to 'Cloud Computing': Consumption of the processing power will increase (rather than decrease)

Improved technology doubles the amount of *Work* produced with a given amount of *Fuel*

Demand for *Fuel* rises

William Stanley Jevons
1835 – 1882

Technological progress that increases the efficiency with which a resource is used tends to increase (rather than decrease) the rate of consumption of that resource

Automation

- Large scale;
  - Deployment
  - Config
  - CI/CD
  - Capacity mgmt
  - Monitoring
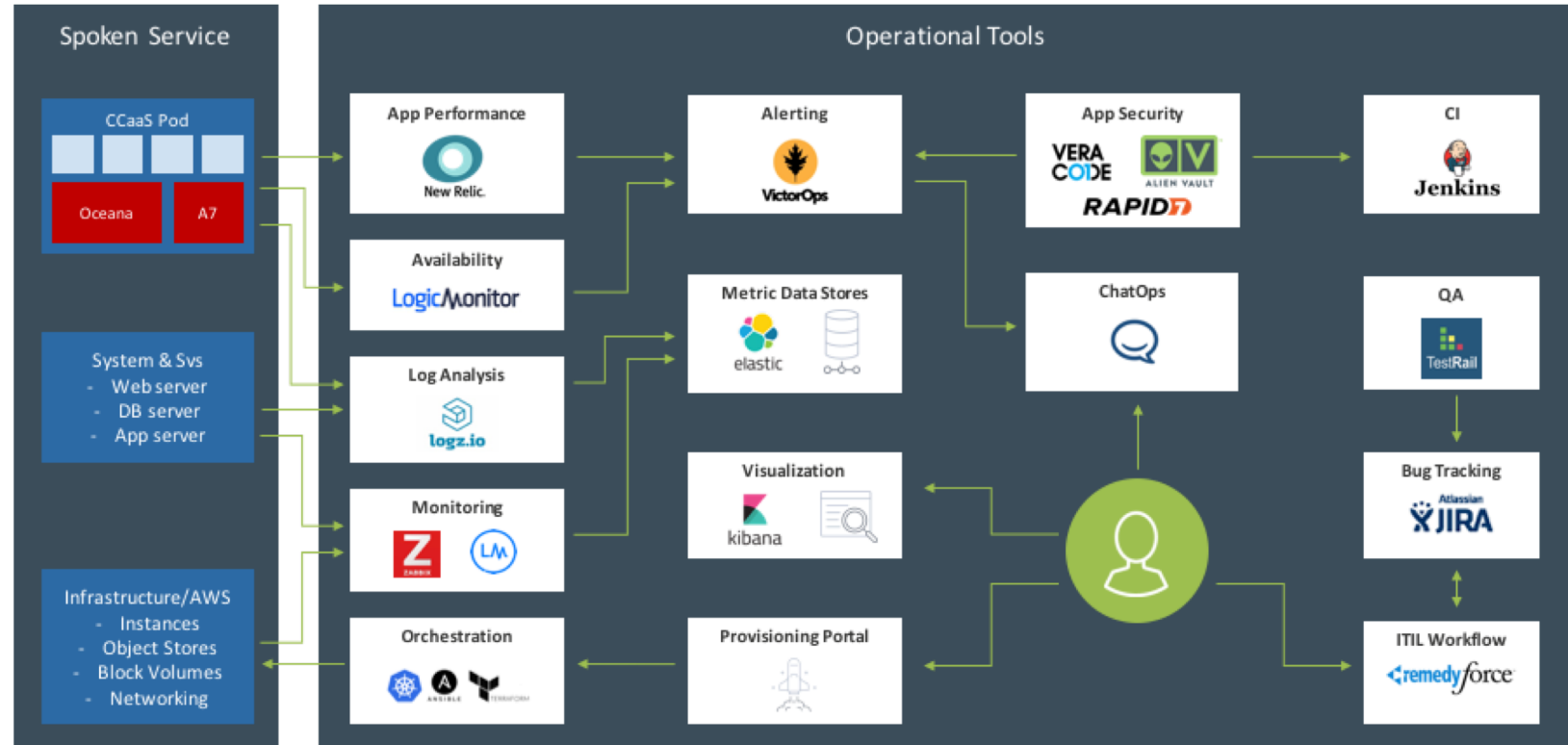
Everything fails… all the time…

- Hardware will fail.
- Software will have bugs
- Force Majeure will hit

- **Focus on restore not on preventing**

AFR harddisk failure
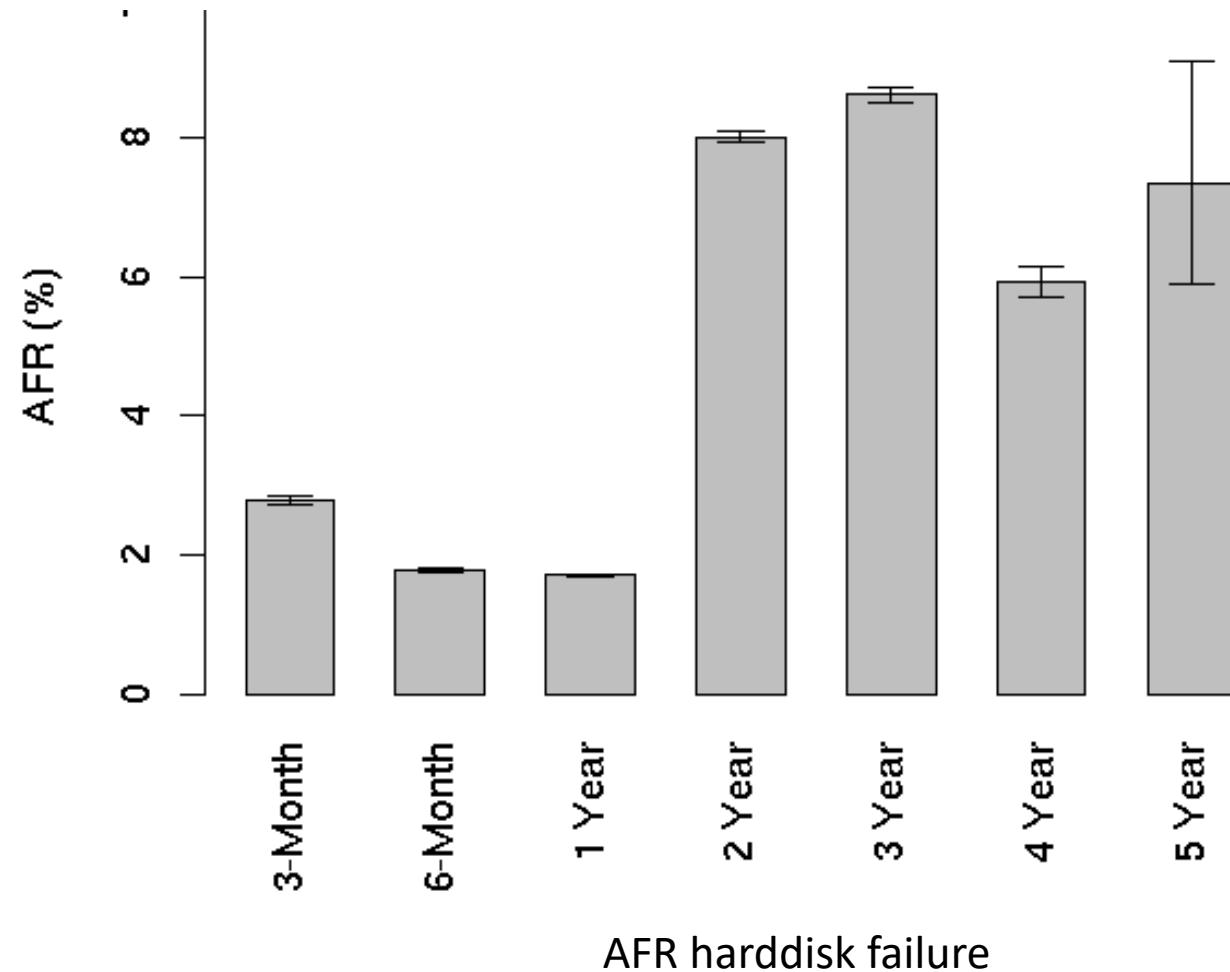
Everything fails... all the time...

- Force Majeure will hit; Amazon datacenter failure 2010
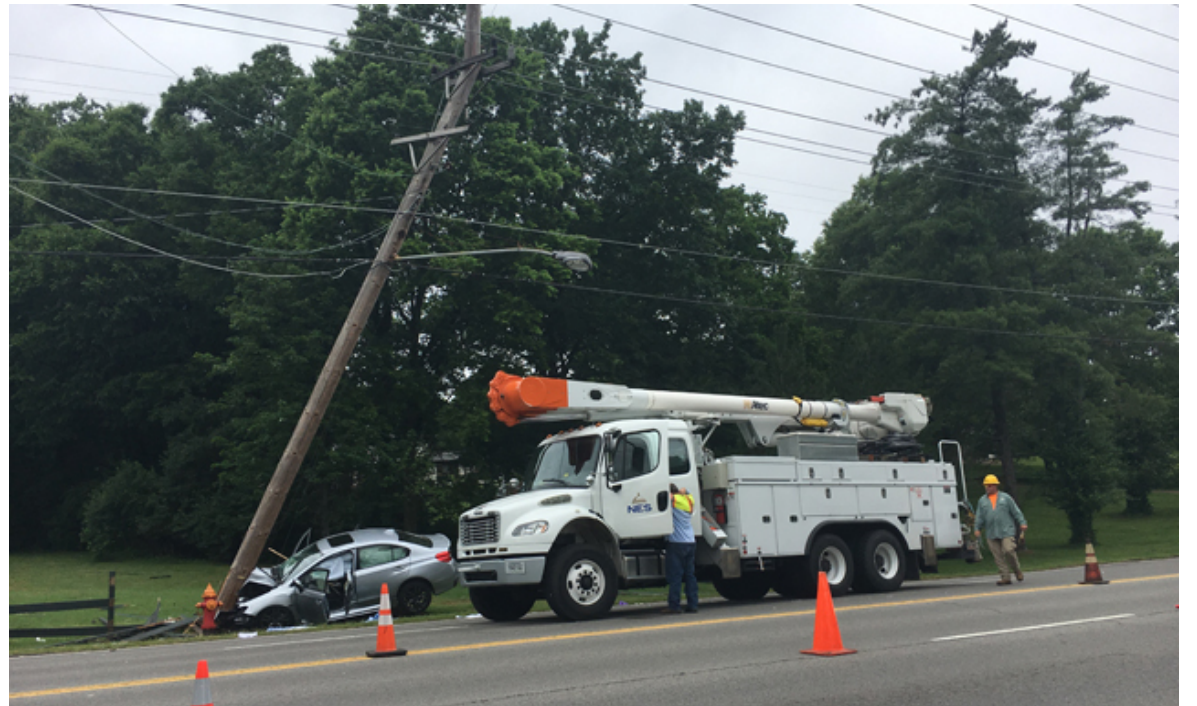
Everything fails… all the time…

- Human error; Amazon S3 failure 2017

Balancing cost and risk

Level of Availability	Percent of Uptime	Downtime per Year	Downtime per Day
1 Nine	90%	36.5 days	2.4 hrs.
2 Nines	99%	3.65 days	14 min.
3 Nines	99.9%	8.76 hrs.	86 sec.
4 Nines	99.99%	52.6 min.	8.6 sec.
5 Nines	99.999%	5.25 min.	.86 sec.
6 Nines	99.9999%	31.5 sec.	8.6 msec
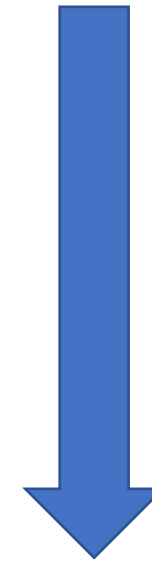
- Cost goes up
- Complexity goes up

Outage !

- What happens ?
  - Typical Process (ITIL or similar)
  - Typical Human behaviour

- What happens after ?
  - Review process, retro or post mortem
  - Typical Human behaviour

Retro's

- When ?
- Who ?
- Structure:
  - Detailed Timeline
  - Root cause
  - What went well
  - What could we have done better
  - Action items
- Automate the input (ChatOps)
- Importance of Blameless Retro's.
- Share retro output internal and external

Materials / references

- Barraso, Clidaras, Holzle: The Datacenter as a Computer. 2009/2013
- Mark Burgess: In Search of Certainty. 2013
- Woods DD. STELLA: Report from the SNAFUcatchers Workshop on Coping With Complexity. 2017.