

Diagnosing The Patient

Holistic Systems Thinking, System-As-Patient
Seattle Code Camp
9.12.2015



Leonardo da Vinci

Image source: https://commons.wikimedia.org/wiki/Leonardo_da_Vinci

Success Criteria for this Talk...

- ▶ If you leave here with just one useful idea that helps you move the ball forward in your career, team, project, or organization...





Speaker Background

- ▶ Name: Kelvin D. Meeks
- ▶ Roles: Sailor, Mentor, Consultant, Senior Architect
- ▶ Specialty: Complex Distributed Systems Integration Problems
- ▶ Medical Expertise: None
- ▶ IT Career: Since 1984...
- ▶ Some Ups:
 - 36 successful banking-related IT projects (for clients in U.S., Australia, Europe, Asia, South America, Middle East)
 - High Performance Online Banking Software running in the world's 50 largest banks
 - High Performance Customer Care System (\$100M+, Finance)
 - High Performance SOA implementation (\$100M+, Insurance)
 - Dot.com start-up (angel funding < \$500K)
 - SaaS Perf Improvements: 10%...80% and ...99% → ~20%
- ▶ Some Downs:
 - National Call Center, Client-Server Project (\$100M+, Telecom)
 - dot.com start-up (\$100M+, E-commerce)



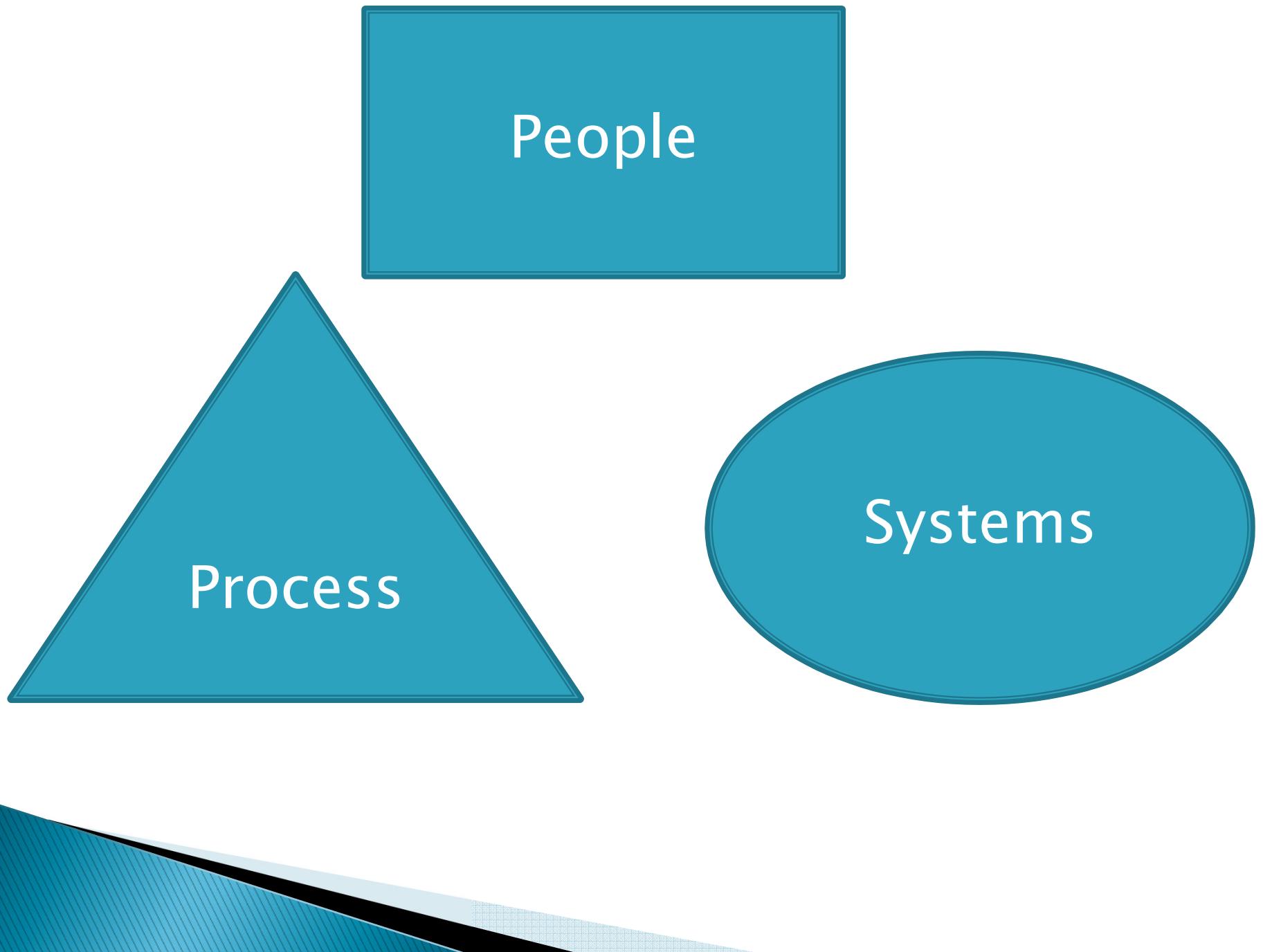
Scenario:

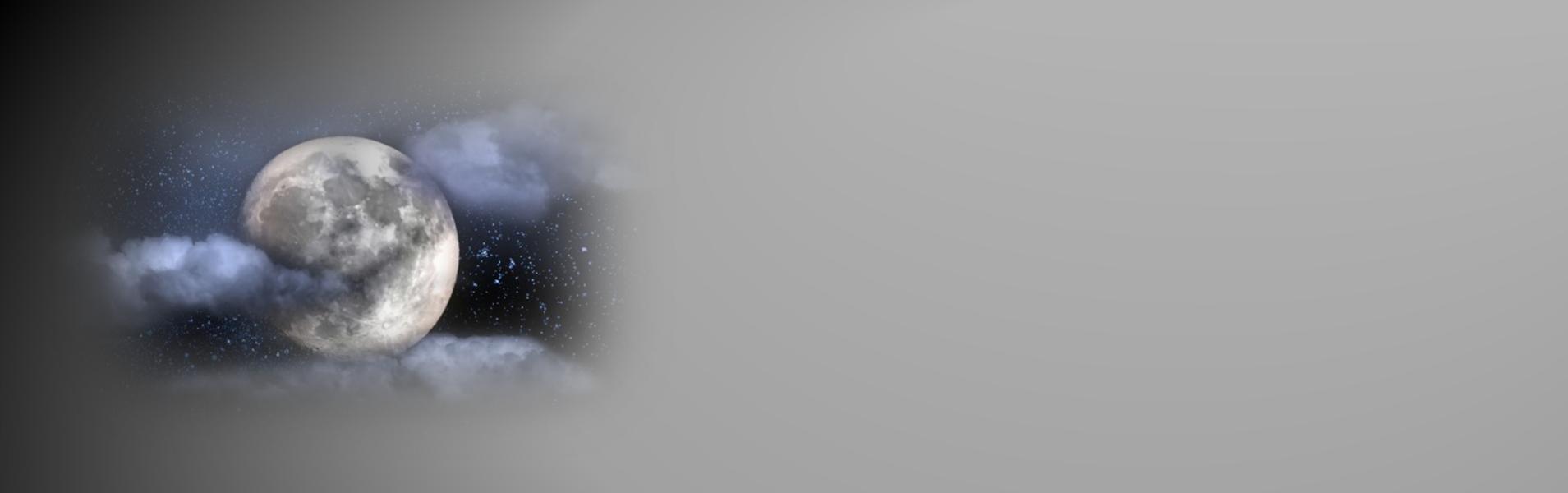
You are an architect, about to join a new endeavor...you're told the system is...‘not well’.

In your first 30–90 days...what should you focus on, and in what order, to optimize the chances that your efforts will be successful?

How will you diagnose the health of your ‘patient’?







»» An Architecture Haiku...

Bad Architecture.
As cloud moves, moon is revealed.
What clouds hide your moon?

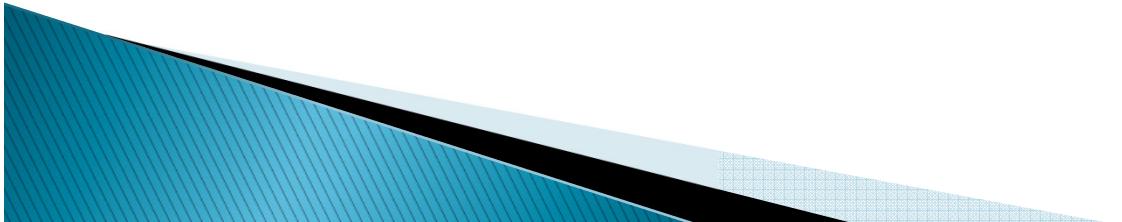
Image source: <http://www.publicdomainpictures.net/view-image.php?image=67180&George+Hodan>, public domain

kyo

cavity, hole, unpreparedness, an unguarded moment,
“what is on the surface is not the truth”

<https://en.glosbe.com/ja/en/%E8%99%9A>

<http://www.seed.org/printable/Kyo%20and%20Jitsu.pdf>

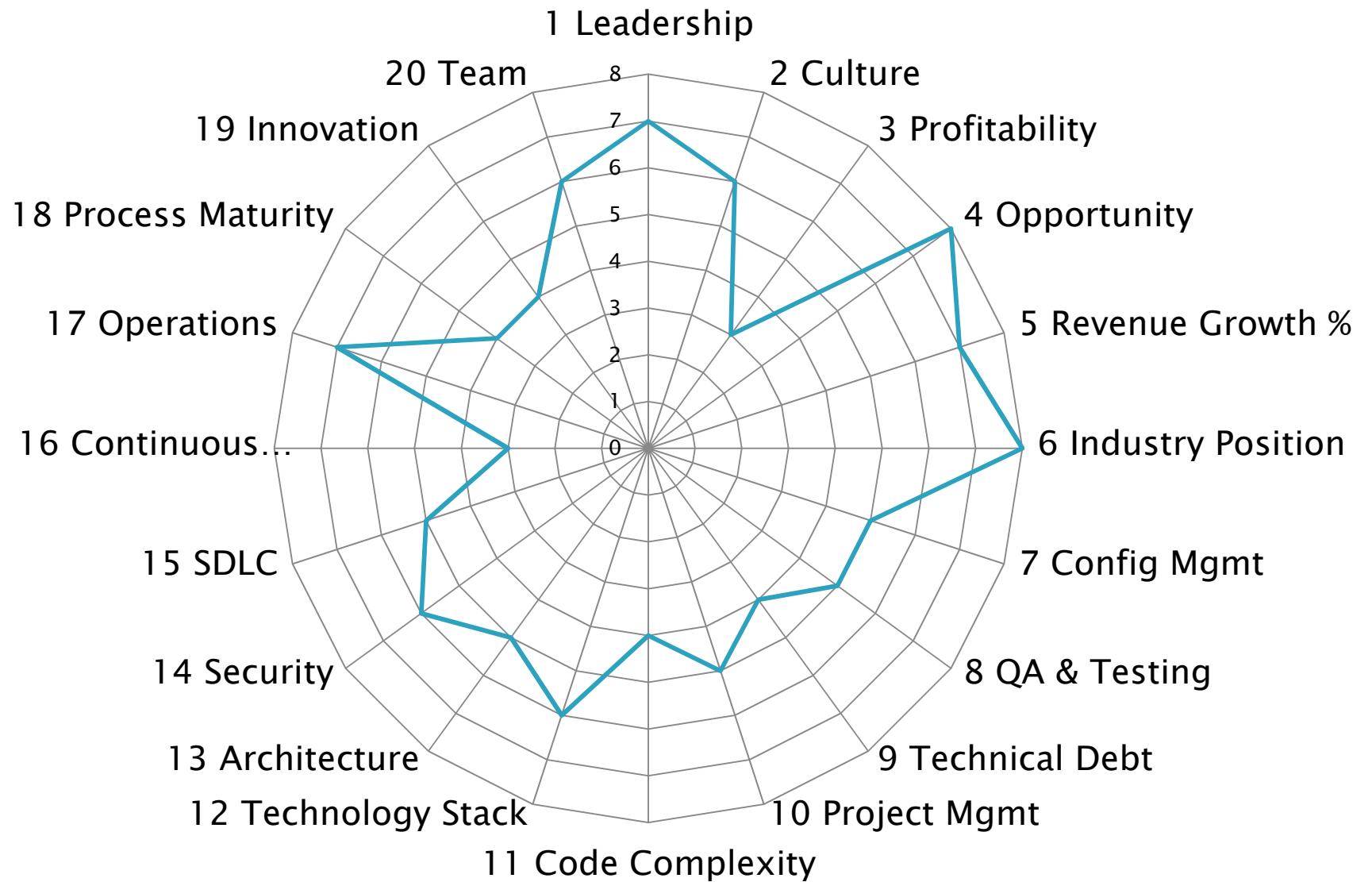


Kyo can arise from Motivations

- ▶ Money
- ▶ Building Fiefdoms
- ▶ Titles
- ▶ Resume Checkboxes
- ▶ “I did that”
- ▶ Consuming/Taking
- ▶ Limiting Access
- ▶ Secrets
- ▶ Focusing on Form
- ▶ Contribution/Achievement
- ▶ Building Influence
- ▶ Competence/Capabilities
- ▶ Beneficial Outcomes
- ▶ “We did that”
- ▶ Producing/Giving
- ▶ Increasing Access
- ▶ Knowledge
- ▶ Focusing on Cause/Effect

Increasing Risk of Kyo

Decreasing Risk of Kyo



Where is your kyo?

Assessing ‘Patient’ Health



Too many Vitamins, or Too many NFRs...**can** be poisonous

Accessibility

Documentation

Interoperability

Portability

Config Mgmt

Availability

Disaster Recovery

Performance

Fault Tolerance

Portability

Quality

Recovery

Resilience

Response Time

Reusability

Robustness

Scalability

Security

Compatibility

Stability

Supportability

Testability

Usability

Etc...

“The opposite of Health?”
“Dis-Ease.”

Source of quote: Zig Ziglar

Symptoms of ‘Patient’ Dis-Ease

- ▶ Lethargic
- ▶ Rigidity
- ▶ Inflexibility
- ▶ Fragile Bones
- ▶ Bad Circulation
- ▶ Necrotic Tissue
- ▶ Fever
- ▶ Bruising
- ▶ Projectile Hurling
- ▶ Hopelessness
- ▶ Neural Impairment
- ▶ Slow System Responsiveness
- ▶ Difficult to modify, Rats Nest
- ▶ Hard Coded, Not Configurable
- ▶ System crashes frequently
- ▶ System Fails under Load
- ▶ Dead Code, Walking Dead
- ▶ Memory/CPU/Storage Hi Util %
- ▶ High Error volume in log files
- ▶ Core Dumps, Exceptions
- ▶ Constant Changes in Direction
- ▶ Ad hoc (~ no) processes

Common ‘Patient’ Mis-Diagnosis

If I Ignore it,
maybe it'll
get better...

“The pain isn’t
that bad”

“It’s just a flesh
wound”

Organ
Replacement

Amputation

Lobotomy



Diagnostically Speaking...

»» Treatment Without
Measurement is Folly...

The Essential Forensic Toolkit

- ▶ Logging
 - ▶ Log Aggregation
 - ▶ Log Analysis & Visualization
 - ▶ Monitoring & Alerting
 - ▶ Measurements
 - ▶ Debugging Tools
 - ▶ Static Code Analysis Tools
 - ▶ Checklists
- Splunk
or ELK
- AppDynamics
or New Relic
- Nagios, Ganglia, etc.



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		I/o Stats.....	

	A	B	C	D
1	Group	ID	NFR Category	Clarifying Question/Requirement
2	A	B	C	D
3	1	2	3	4
4	2	1	2	3
5	3	2	1	4
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263	261	260	259	262
264	262	261	260	263
265	263	262</td		

Understand Your Selected Algorithm's Complexity & Impact

A	B $O(\log n)$	C $O(n)$	D $O(n\log n)$	E $O(n^2)$	F $O(2^n)$	G $O(n!)$
1	0	1	0	1	2	1
2	0.301029996	2	0.602059991	4	4	2
3	0.477121255	3	1.431363764	9	8	6
4	0.602059991	4	2.408239965	16	16	24
5	0.698970004	5	3.494850022	25	32	120
6	0.77815125	6	4.668907502	36	64	720
7	0.84509804	7	5.91568628	49	128	5040
8	0.903089987	8	7.224719896	64	256	40320
9	0.954242509	9	8.588182585	81	512	362880
10	1	10	10	100	1024	3628800
11	1.041392685	11	11.45531954	121	2048	39916800
12	1.079181246	12	12.95017495	144	4096	479001600
13	1.113943352	13	14.48126358	169	8192	6227020800
14	1.146128036	14	16.0457925	196	16384	87178291200
15	1.176091259	15	17.64136889	225	32768	1.30767E+12
16	1.204119983	16	19.26591972	256	65536	2.09228E+13
17	1.230448921	17	20.91763166	289	131072	3.55687E+14
18	1.255272505	18	22.59490509	324	262144	6.40237E+15
19	1.278753601	19	24.29631842	361	524288	1.21645E+17
20	1.301029996	20	26.02059991	400	1048576	2.4329E+18
21	1.322219295	21	27.76660519	441	2097152	5.10909E+19
22	1.342422681	22	29.53329898	484	4194304	1.124E+21
23	1.361727836	23	31.31974023	529	8388608	2.5852E+22
24	1.380211242	24	33.1250698	576	16777216	6.20448E+23
25	1.397940009	25	34.94850022	625	33554432	1.55112E+25
26	1.414973348	26	36.78930705	676	67108864	4.03291E+26
27	1.431363764	27	38.64682163	729	134217728	1.08889E+28
28	1.447158031	28	40.52042488	784	268435456	3.04888E+29
29	1.462397998	29	42.40954194	841	536870912	8.84176E+30
30	1.477121255	30	44.30000000	901	1073741824	2.35105E+32
92	1.963787827	92	180.6684801	8464	4.95176E+27	1.2438E+142
93	1.968482949	93	183.0689142	8649	9.90352E+27	1.1568E+144
94	1.973127854	94	185.4740182	8836	1.9807E+28	1.0874E+146
95	1.977723605	95	187.8837425	9025	3.96141E+28	1.033E+148
96	1.982271233	96	190.2980384	9216	7.92282E+28	9.9168E+149
97	1.986771734	97	192.7168582	9409	1.58456E+29	9.6193E+151
98	1.991226076	98	195.1401554	9604	3.16913E+29	9.4269E+153
99	1.995105	99	197.5644742	9799	6.33856E+29	9.2429E+155

Also see: <http://bigocheatsheet.com/>

Reference: https://en.wikipedia.org/wiki/Big_O_notation

The 5 Whys

5 Whys is an iterative interrogative technique used to explore the **cause-and-effect** relationships underlying a particular problem.

The primary goal of the technique is to determine the root cause of a defect or problem by repeating the question "Why?" Each question forms the basis of the next question.

The "5" in the name derives from an **empirical observation on the number of iterations typically required to resolve the problem**

1st Why is the system slow?

The DB is slow

2nd Why is the database slow?

The app executes a lot of queries to load a page

3rd Why is the app designed to be so chatty?

DB was designed in an inefficient manner by [X]

4th Why didn't [X] use an efficient DB design?

[X] was never trained on database design

5th Why didn't [X] get any DB design training?

There is no budget for training

1st Order Effect:

Bad Hiring Decisions

No Funding Allocated for Training

Bad Requirements

2nd Order Effect:

Engineers lack proper skills

Engineers build the wrong thing

3rd Order Effect:

Systems are not built or maintained properly

High levels of rework

4th Order Effect:

Systems are slow

Maintenance costs rise

5th Order Effect:

Organization is unable to respond to market needs quickly.



Where to focus first?

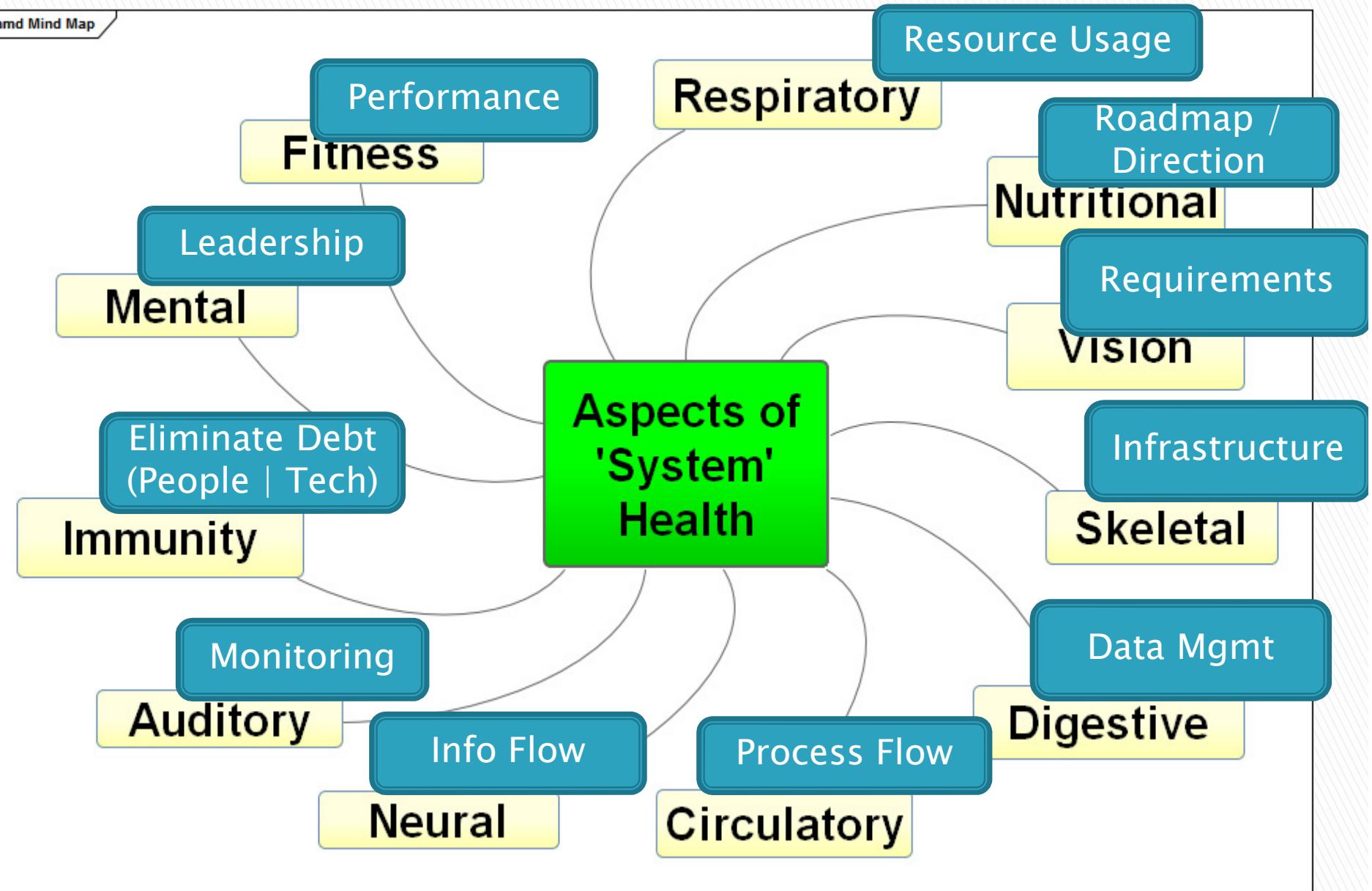
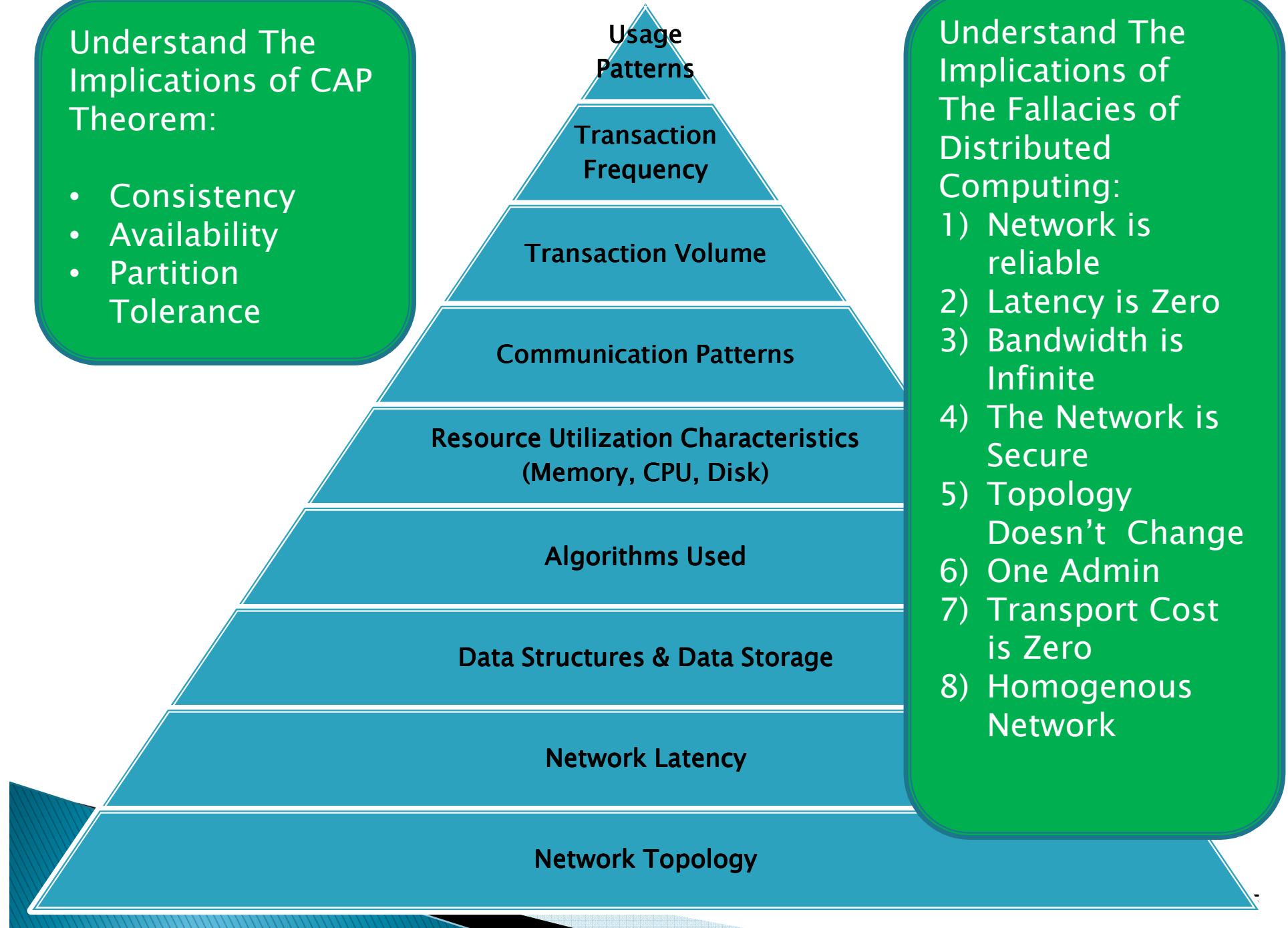


Image source: Kelvin D. Meeks

Understand The Implications of CAP Theorem:

- Consistency
- Availability
- Partition Tolerance



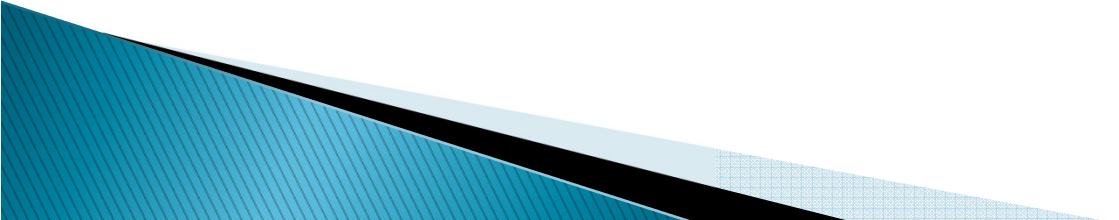
Understand The Implications of The Fallacies of Distributed Computing:

- 1) Network is reliable
- 2) Latency is Zero
- 3) Bandwidth is Infinite
- 4) The Network is Secure
- 5) Topology Doesn't Change
- 6) One Admin
- 7) Transport Cost is Zero
- 8) Homogenous Network

The Mysterious Case of We Need A New System (or, The CPU has a Fever)

Metrics Are Critical

Triage Skills Are Essential



The Mysterious Case of NIC Fever

Metrics Can Lie

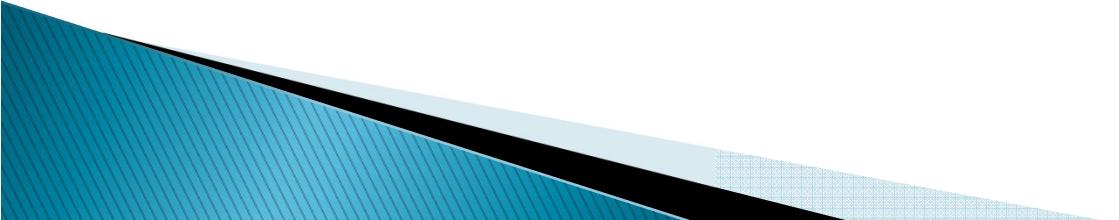
Get 2nd, 3rd Verification



The Mysterious Case of The System is Slow

Partial Metrics Are Insufficient

End-to-End Forensics are Vital



The Mysterious Case of The Corrupted Data

**“When you have eliminated the impossible,
whatever remains,
however improbable,
Must be the truth”**

-Sherlock Holmes

The Mysterious Case of The System Fault

There are more things in heaven and
earth, Horatio,
Than are dreamt of in your philosophy.
– *Hamlet* (1.5.167–8), Hamlet to Horatio

Growing & Learning The Way of The Architect

»» The Ten Ox

The Ten Ox

“... illustrate the stages of a practitioner's progression...”

“...comes from the Maha Gopalaka Sutta
(Majjhima Nikaya 33)”

Appeared in China ~12th century

Verses by Kuòān Shīyuǎn;
Translation by Senzaki Nyogen (1876–1958) and Paul
Reps (1895–1990);
Paintings traditionally attributed to Tenshō Shūbun
(1414–1463).

Source: https://en.wikipedia.org/wiki/Ten_Bulls

Source: https://en.wikipedia.org/wiki/Ten_Bulls



1. In Search of the Ox
In the pasture of the world, I endlessly push aside the tall grasses in search of the Ox. Following unnamed rivers, lost upon the interpenetrating paths of distant mountains, My strength failing and my vitality exhausted, I cannot find the Ox.

Commentary:
The Ox is not lost – it is the Architect who is lost ...in the midst of sensory overload, unable to discern truth or what is essential from the Ten-Thousand Things.

Source: https://en.wikipedia.org/wiki/Ten_Bulls



2. Discovery of the Footprints

*Along the riverbank
under the trees,
I discover footprints.
Even under the fragrant
grass, I see his prints.
Deep in remote
mountains they are
found. These traces can
no more be hidden
than one's nose,
looking heavenward*

Commentary:

The Architect has discovered hints of Patterns, but cannot yet discern good patterns from bad. Clinging to hammer – everything looks like a nail.

Source: https://en.wikipedia.org/wiki/Ten_Bulls



3. Perceiving the Ox
*I hear the song of the nightingale.
The sun is warm, the wind is mild,
willows are green along the shore –
Here no Ox can hide!
What artist can draw that massive head,
those majestic horns?*

Commentary:
The six senses merge, the Architect has entered the gate and the myriad illusions of false patterns fall away. The Architect focuses on First Principles – and is not blinded by the next Shiny New Thing.

Source: https://en.wikipedia.org/wiki/Ten_Bulls



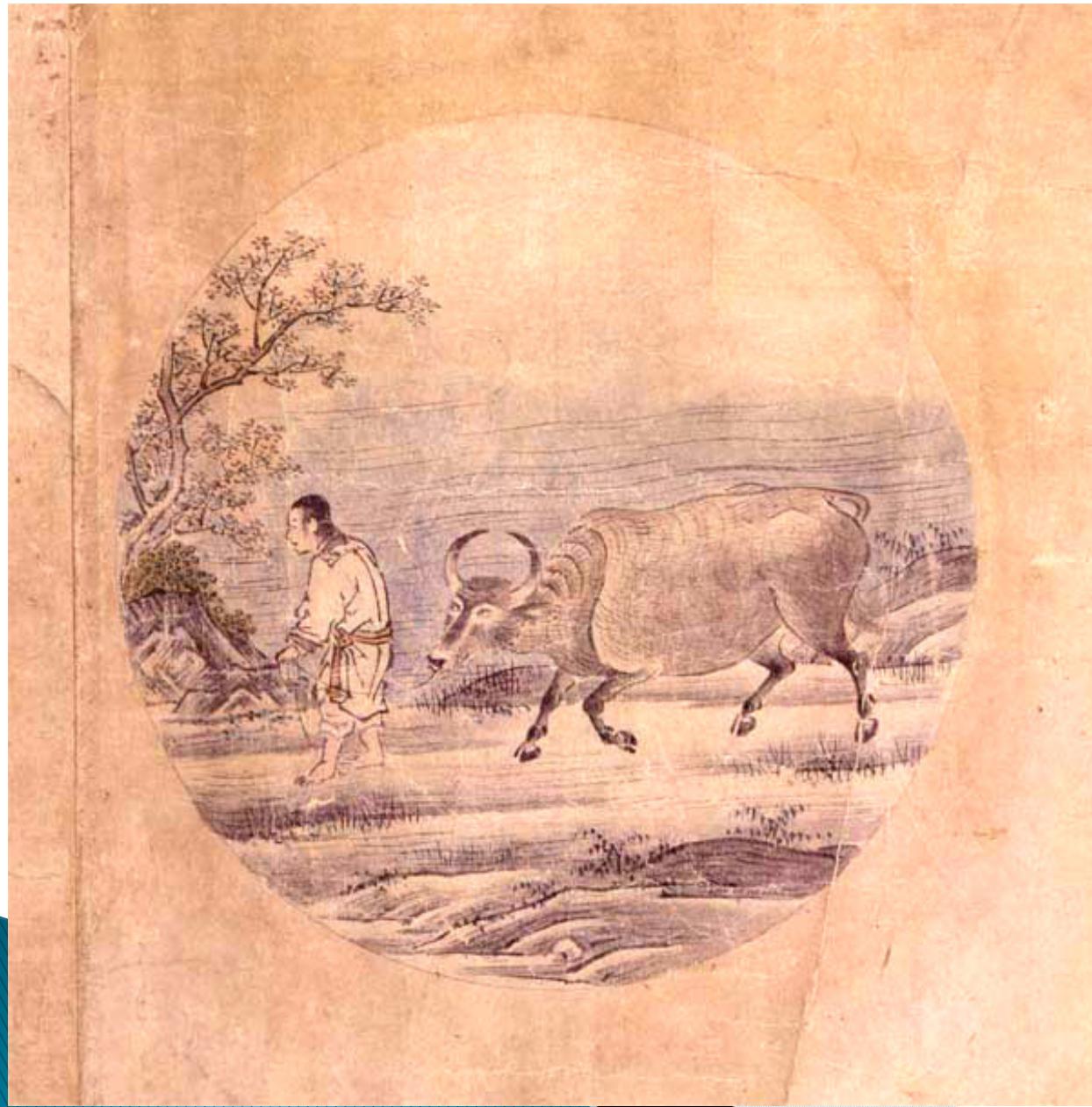
4. Catching the Ox

*I seize him with a
terrific struggle.
His great will and power
are inexhaustible.
He charges to the high
plateau far above the
cloud-mists,
Or in an impenetrable
ravine he stands*

Commentary:

The Architect must resist clinging to comfortable ways that are known – and continually struggle to avoid becoming complacent and stagnating. The oh-so-subtle trap of feeling comfortable with what you know...

Source: https://en.wikipedia.org/wiki/Ten_Bulls



5. Taming the Ox

The whip and rope are necessary, Else he might stray off down some dusty road.

Being well-trained, he becomes naturally gentle. Then, unfettered, he obeys his master.

Commentary:

The Architect has learned how to master the use of Patterns and appropriate technologies in a natural way – and does not try to force a tool (NoSQL?) to solve a problem in an unnatural way. CAP Theorem is still a challenge...

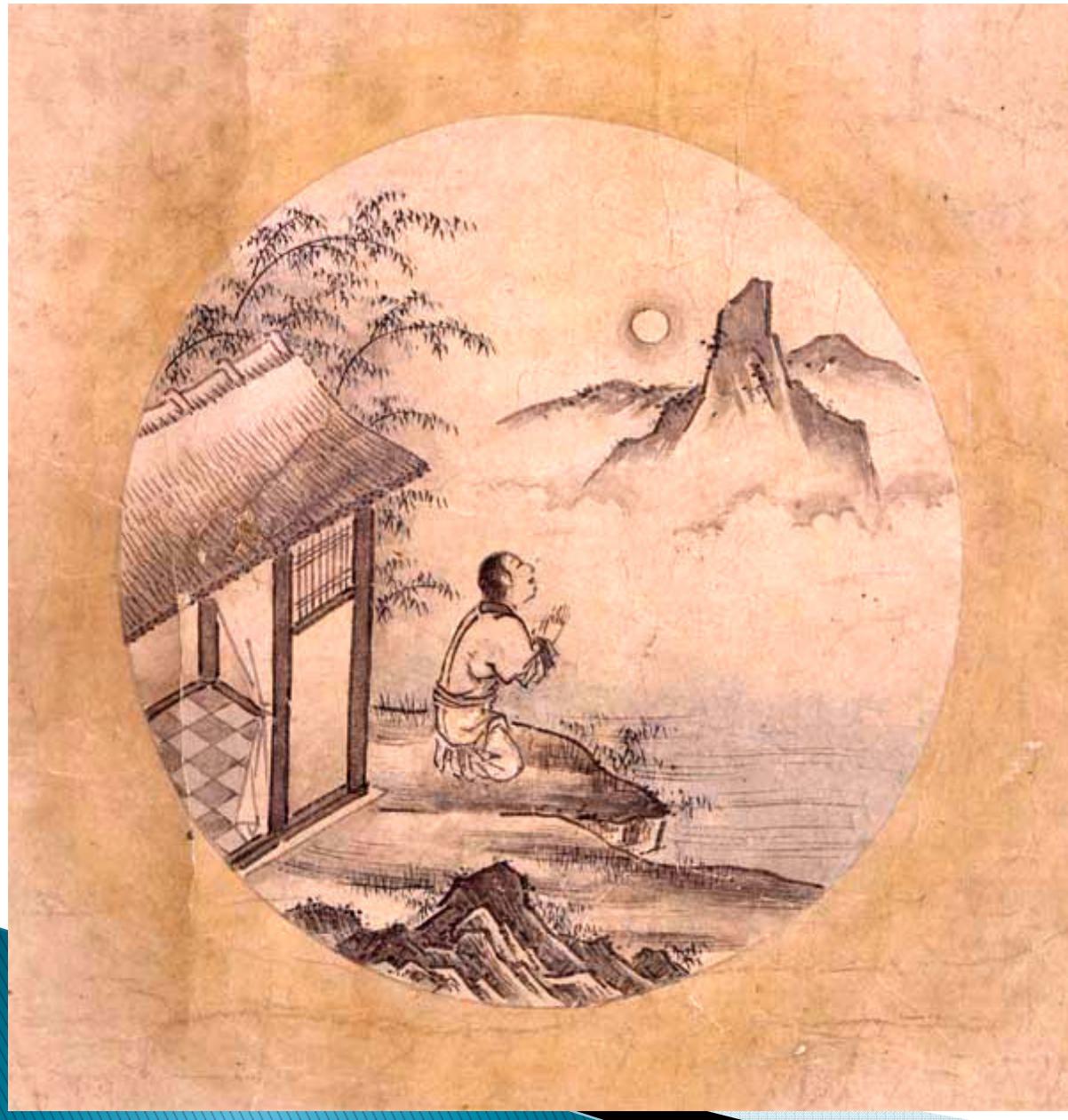
Source: https://en.wikipedia.org/wiki/Ten_Bulls



6. Riding the Ox Home
*Mounting the Ox, slowly
I return homeward.
The voice of my flute
intones through the
evening.
Measuring with hand-
beats the pulsating
harmony, I direct the
endless rhythm.
Whoever hears this
melody will join me.*

Commentary:
The Architect has achieved the level of Master Craftsman and has internalized his knowledge – and uses Patterns correctly and instinctively. Even NoSQL.

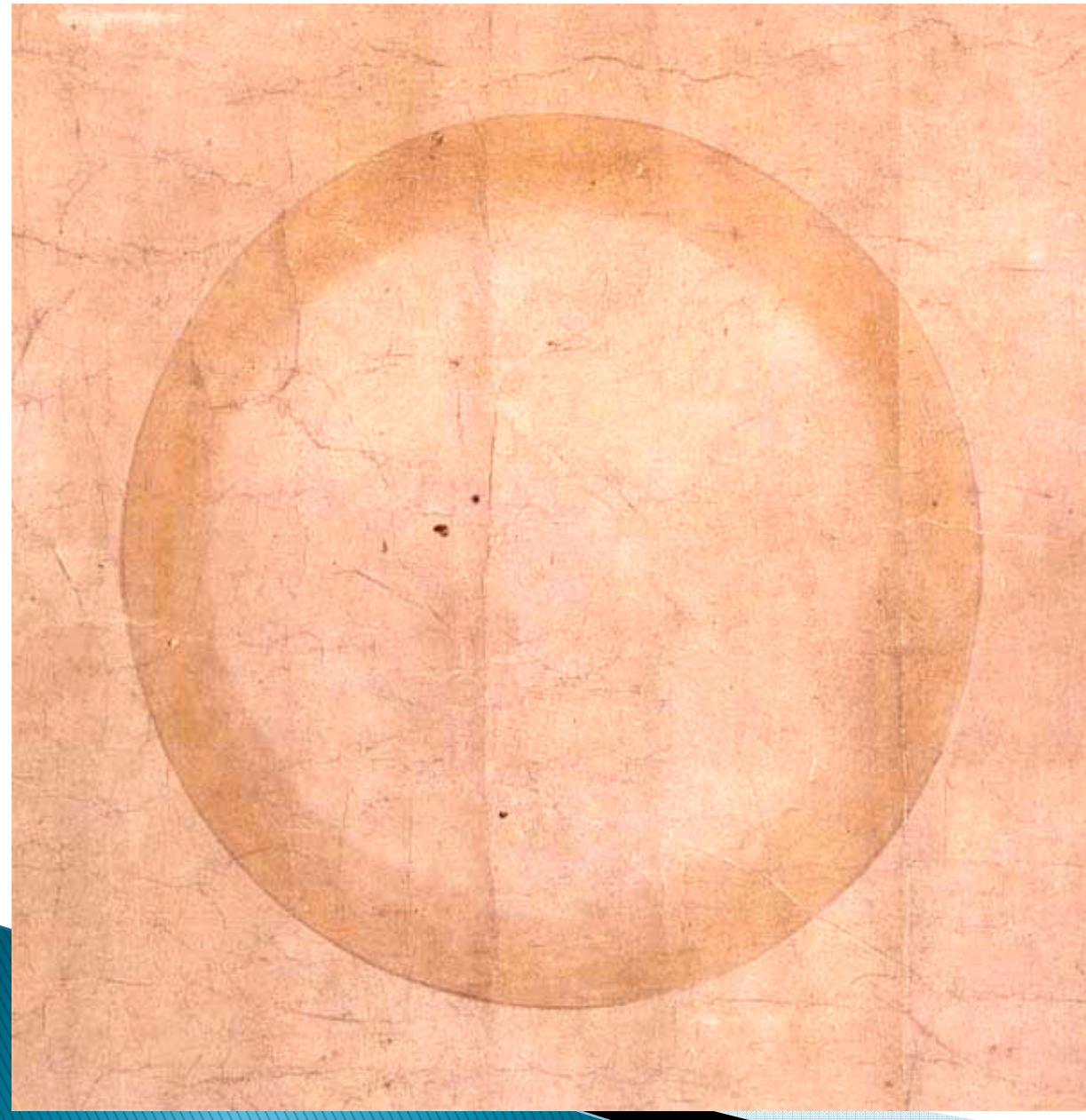
Source: https://en.wikipedia.org/wiki/Ten_Bulls



7. The Ox Transcended
*Astride the Ox, I reach home.
I am serene. The Ox too can rest.
The dawn has come.
In blissful repose,
Within my thatched dwelling I have abandoned the whip and ropes*

Commentary:
The Architect has transcended the need for the guidance and restrictions of known Patterns – and is free to explore problems in new and innovative ways. This may also be when the Architect decides to join Management...

Source: https://en.wikipedia.org/wiki/Ten_Bulls



8. Both Ox and Self Transcended

Whip, rope, person, and Ox – all merge in No Thing.

*This heaven is so vast,
no message can stain it.
How may a snowflake
exist in a raging fire.
Here are the footprints
of the Ancestors.*

Commentary:

The Architect sees everything as having a pattern – and yet the highest pattern is no-pattern.

Source: https://en.wikipedia.org/wiki/Ten_Bulls



9. Reaching the Source

Too many steps have been taken returning to the root and the source. Better to have been blind and deaf from the beginning!

*Dwelling in one's true abode, unconcerned with and without –
The river flows tranquilly on and the flowers are red.*

Commentary:

The Architect is at peace with that which is – and that which cannot be helped (COBOL still lives) – and accepts Eventual Consistency

Source: https://en.wikipedia.org/wiki/Ten_Bulls



10. Return to Society
*Barefooted and naked
of breast, I mingle with
the people of the world.
My clothes are ragged
and dust-laden,
and I am ever blissful.
I use no magic to
extend my life;
Now, before me, the
dead trees become
alive.*

Commentary:
The Architect turns
outward to teach that
which has been
learned.

A Few Final Thoughts...



Enthusiasm~Enthous~“God Within”

Create Feeling by Action First

- ▶ *“If you aren’t fired with enthusiasm, you will be fired with enthusiasm.”*
 - Vince Lombardi (1913 – 1970, football coach of the Green Bay Packers and Washington Redskins)
- ▶ *“Enthusiasm is one of the most powerful engines of success. When you do a thing, do it with your might. Put your whole soul into it. Stamp it with your own personality. Be active, be energetic, be enthusiastic and faithful, and you will accomplish your object. Nothing great was ever achieved without enthusiasm.”*
 - Ralph Waldo Emerson (1803 – 1882), Philosopher, essayist, and poet



On Preparation

"Experience is a hard teacher because she gives the test first, the lesson afterward."

– Vernon Law (Former Pirates pitcher)

"If you fail to prepare, you're prepared to fail."

– Mark Spitz



Be In The Game

"In baseball and in business, there are three types of people. Those who make it happen, those who watch it happen, and those who wonder what happened."

– Tommy Lasorda (MLB Pitcher, Manager)

"I've missed more than 9,000 shots in my career...I've failed over and over and over again in my life. And that is why I succeed."

– Michael Jordan



Embrace Change: Shuhari

- ▶ <https://en.wikipedia.org/wiki/Shuhari>
 - ▶ **Shu:** “first learn” ~ obey traditional wisdom – learning fundamentals, techniques, heuristics, proverbs
 - ▶ **Ha:** “then detach” ~ breaking with tradition — detachment from the illusions of self
 - ▶ **Ri:** “then transcend” ~ there are no techniques or proverbs, all moves are natural, becoming one with spirit alone without clinging to forms; transcending the physical



Additional Suggested Resources

- ▶ Clean Code: A Handbook of Agile Software Craftsmanship
 - <http://www.amazon.com/Clean-Code-Handbook-Software-Craftsmanship/dp/0132350882>
- ▶ Peopleware: Product Projects and Teams, 3rd Ed., Tom DeMarco
 - <http://www.amazon.com/Peopleware-Productive-Projects-Teams-Edition-ebook/dp/B00DY5A8X2>
- ▶ South: The Endurance Expedition, by Ernest Shackleton
 - <http://www.amazon.com/gp/product/0451198808/>
- ▶ The Mythical Man-Month: Essays on Software Engineering, (2nd Ed.)
 - <http://www.amazon.com/Mythical-Man-Month-Software-Engineering-Anniversary/dp/0201835959>
- ▶ Beautiful Code: Leading Programmers Explain How They Think
 - <http://www.amazon.com/Beautiful-Code-Leading-Programmers-Practice/dp/0596510047/>
- ▶ Coders at Work: Reflections on the Craft of Programming
 - <http://www.amazon.com/gp/product/1430219483>
- ▶ Zen Flesh Zen Bones: A Collection of Zen and Pre-Zen Writings, by Paul Reps, Nyogen Senzaki
 - <http://www.amazon.com/Zen-Flesh-Bones-Collection-Writings/dp/0804831866>
- ▶ The Dreyfus Model of Skill Acquisition
 - https://en.wikipedia.org/wiki/Dreyfus_model_of_skill_acquisition
- ▶ Jeff Dean's 2009 talk
 - Designs, Lessons and Advice from Building Large Distributed Systems
 - <http://static.googleusercontent.com/media/research.google.com/en//people/jeff/WSDM09-keynote.pdf>

Additional Suggested Resources

- ▶ <http://www.HighScalability.com>
- ▶ <Http://www.papersthatrock.org>
- ▶ <https://github.com/papers-we-love/papers-we-love>
- ▶ YouTube: [Microsoft Research](#)
- ▶ YouTube: [Amazon Web Services](#)
- ▶ YouTube: [O'Reilly](#)
- ▶ YouTube: [StrangeLoop](#)
- ▶ YouTube: [GoogleTechTalks](#)
- ▶ YouTube: [InfoQ](#)
- ▶ https://en.wikipedia.org/wiki/CAP_theorem
- ▶ https://en.wikipedia.org/wiki/Fallacies_of_distributed_computing



Thank You

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