2019 ICEAA Canada Workshop
September 17-18, 2019 Ottawa Marriott

The Future of IT and Software Estimating

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QUALITY PLUS TECHNOLOGIES, INC.

About
Quality Plus Technologies, Inc.

USA-based consulting, training, and coaching services in project management (PMP), software measurement estimation, benchmarking, scope management, ISO stds


About me…
"CanAmerican" engineer – 25 years in FL
2 grown children, 2 granddaughters
A few favorites: sunsets, sailing, TB Lightning, volunBEERs

Wouldn't it be fun to have a crystal ball to predict the future of IT and software estimating? In this presentation, let’s go on roller coaster ride of prognostications based on where we've been, what's going well today and what trends are on the horizon. Let's have some fun connecting the dots between the world today and where we might end up in the future with ICEAA and IT and software estimating.

Crystal Balls and Rollercoasters and Software

- Basics
- Models and Questions
- Trends
- Expectations
- Software Estimating

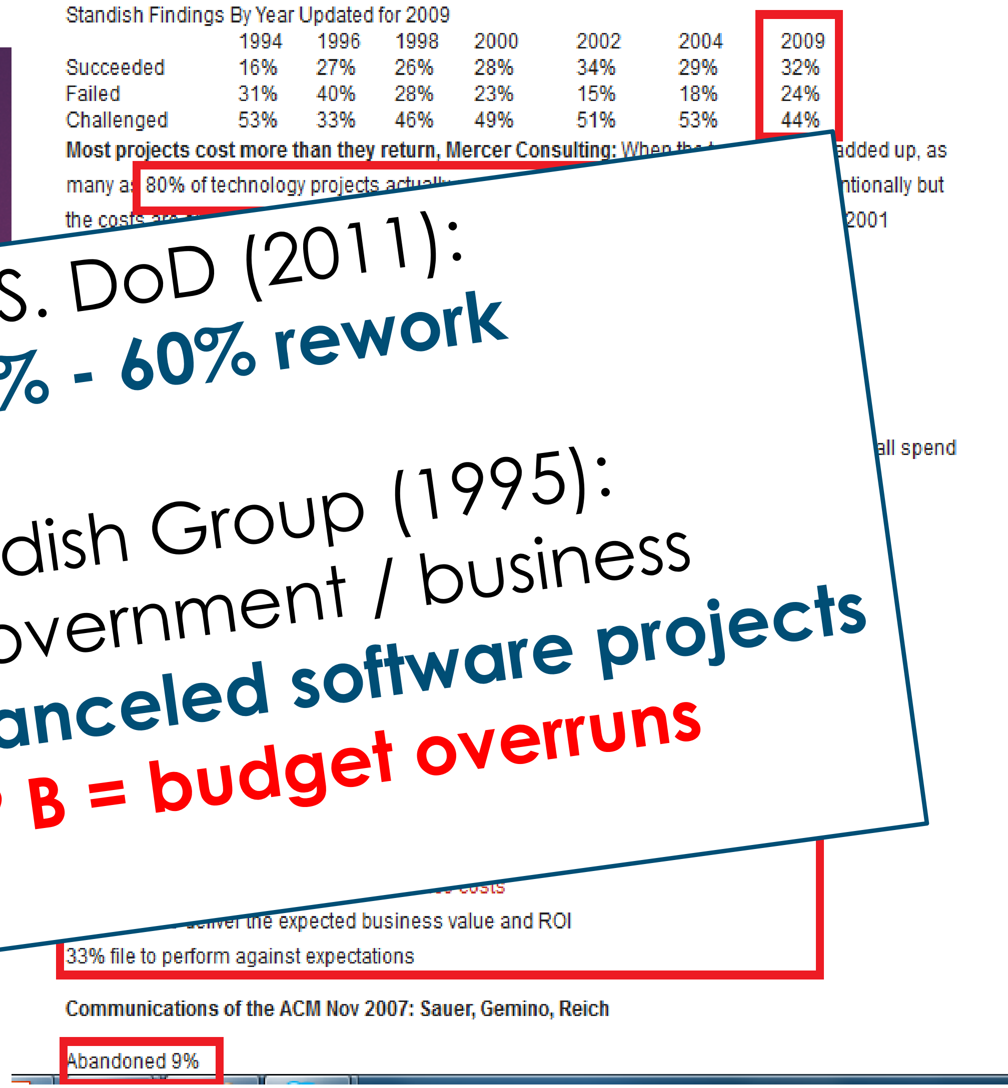
Where are we in “IT”?
Past → Present

YEAR	COMPANY	OUTCOME (COSTS IN US $)
2005	Hudson Bay Co. [Canada]	Problems with inventory system contribute to $33.3 million* loss.
2004–05	UK Inland Revenue	Software errors contribute to $3.45 billion* tax-credit overpayment.
2004	Avis Europe PLC [UK]	Enterprise resource planning (ERP) system canceled after $54.5 million† is spent.
2004	Ford Motor Co.	Purchasing system abandoned after deployment costing approximately $400 million.
2004	J Sainsbury PLC [UK]	Supply-chain management system abandoned after deployment costing $527 million.†
2004	Hewlett-Packard Co.	Problems with ERP system contribute to $160 million loss.
2003–04	AT&T Wireless	Customer relations management (CRM) upgrade problems lead to revenue loss of $100 million.
2002	McDonald's Corp.	The Innovate information-purchasing system canceled after $170 million is spent.
2002	Sydney Water Corp. [Australia]	Billing system canceled after $33.2 million† is spent.
2002	CIGNA Corp.	Problems with CRM system contribute to $445 million loss.
2001	Nike Inc.	Problems with supply-chain management system contribute to $100 million loss.
2001	Kmart Corp.	Supply-chain management system canceled after $130 million is spent.
2000	Washington, D.C.	City payroll system abandoned after deployment costing $25 million.
1999	United Way	Administrative processing system canceled after $12 million is spent.
1999	State of Mississippi	Tax system canceled after $11.2 million is spent; state receives $185 million damages.
1999	Hershey Foods Corp.	Problems with ERP system contribute to $151 million loss.
1998	Snap-on Inc.	Problems with order-entry system contribute to revenue loss of $50 million.

Note: "Bad" cost estimates were not **the reason** for project "failure" but, when failure = $ $ $ …

Software industry stats a decade ago

http://www.galo
project-failure-c
estimation-plann


Standish Findings By Year Updated for 2009

	1994	1996	1998	2000	2002	2004	2009
Succeeded	16%	27%	26%	28%	34%	29%	32%
Failed	31%	40%	28%	23%	15%	18%	24%
Challenged	53%	33%	46%	49%	51%	53%	44%

Most projects cost more than they return, Mercer Consulting: When the
added up, as
many as 80% of technology projects actually
ntionally but
the costs
2001

all spend

deliver the expected business value and ROI
33% file to perform against expectations

Communications of the ACM Nov 2007: Sauer, Gemino, Reich

Abandoned 9%

U.S. DoD (2011):
40% - 60% rework

Standish Group (1995):
U.S. government / business
~ $81B = canceled software projects
~ $59 B = budget overruns

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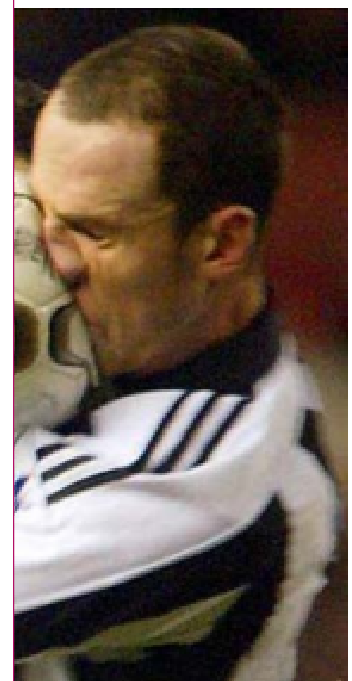
Time to Get Serious - Remove Impediments

1. Congressional inquiry
2. Project internalized
3. The FBI CIO takes ownership
4. Agile is adopted as the project framework
   a) Design is broken into 670 user stories
   b) Self-organizing teams
   c) 45 staff (not 300 as previous)
   d) Product Owner prioritized the work
   e) Two week sprints
   f) Demo every sprint



ureau of Inve

FBI system finally succeeds…

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Outcome, Rubber Meets Road

1. After a few sprints, it became possible to forecast the rough timescales and start to plan the dates for incremental business change and adoption of releases of the new software.
2. System delivered using only half of the budget.
3. Agents used the system on real cases. In the first quarter of its use, over 13,000 agents progressed over 600 cases, meeting or exceeding all expected targets.
4. The old mainframe system was turned off.

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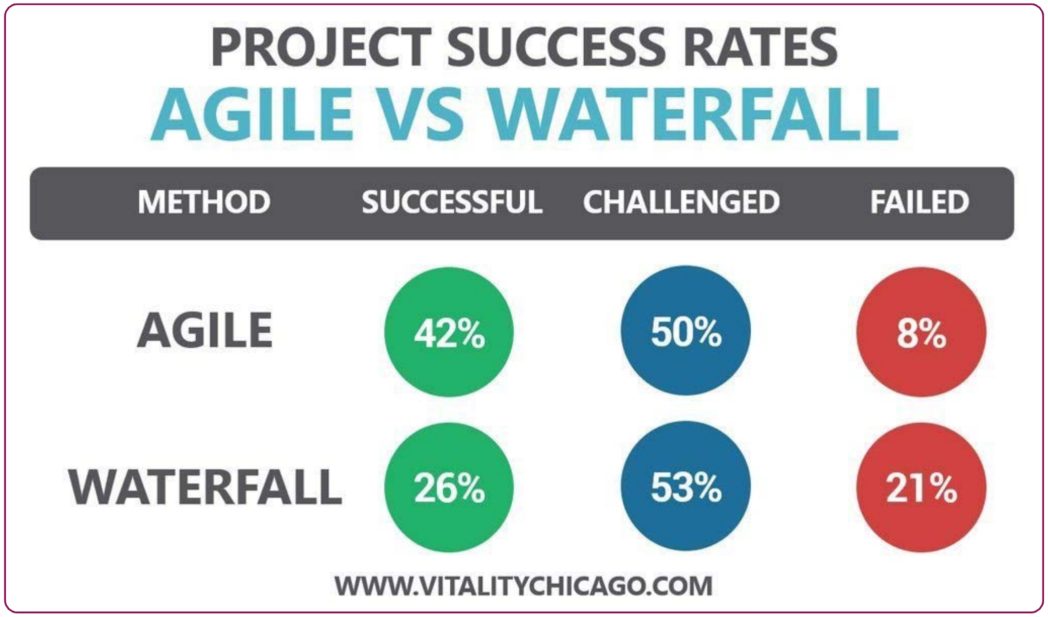
Outcome in Dollars and Cents

1. The three-year Agile project delivered the requested system and improvements.
2. A success after 10 years of failure and $600 million wasted on the two previous aborted 'Waterfall' attempts.
3. Total cost of only $99 million.

Source: https://resources.sei.cmu.edu/asset_files/Presentation/2017_017_001_495733.pdf
Thomas Friend: Agile Project Success and Failure (The Story of the FBI Sentinel Program)

Standish Group CHAOS report (2015)

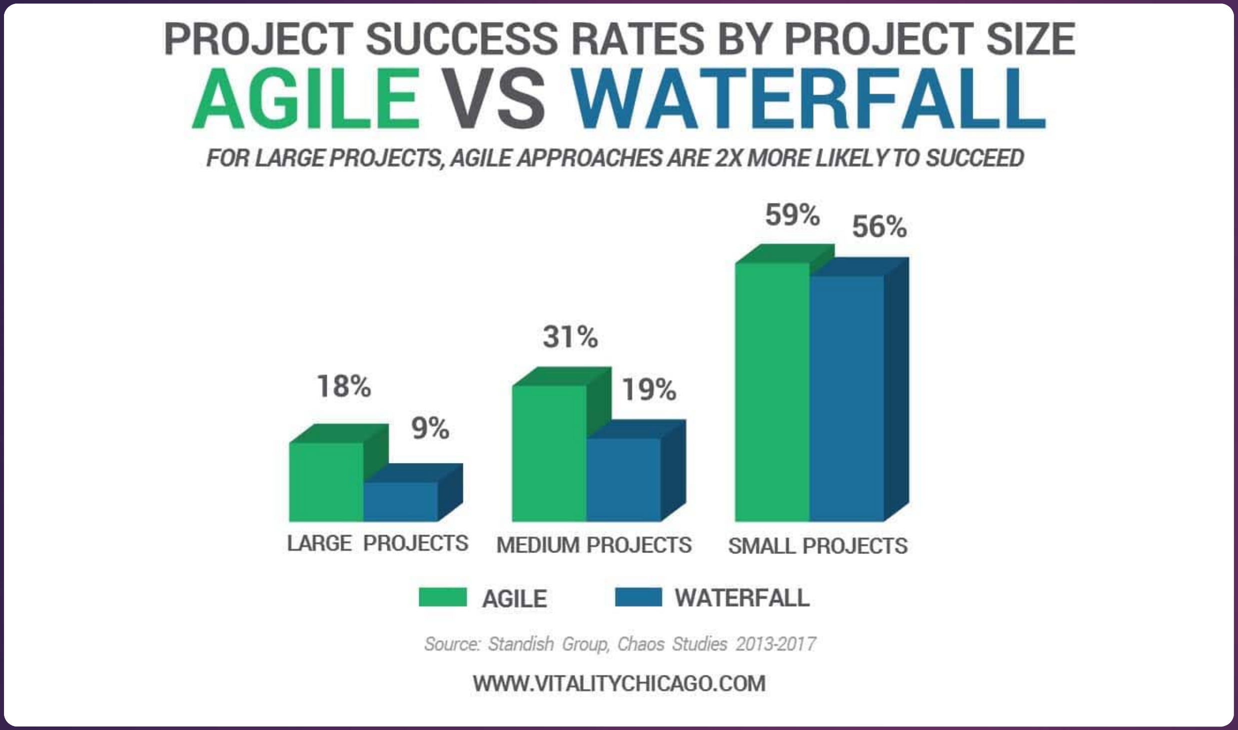
- **Success =** On time**, on budget,** with all features
- **Challenged =** delivered but either late or **overbudget,** or missing features
- **Failed / cancelled =** no delivery



PROJECT SUCCESS RATES
AGILE VS WATERFALL

METHOD	SUCCESSFUL	CHALLENGED	FAILED
AGILE	42%	50%	8%
WATERFALL	26%	53%	21%

WWW.VITALITYCHICAGO.COM



Standish Group CHAOS reports 2013-2017

PMI Study 2017

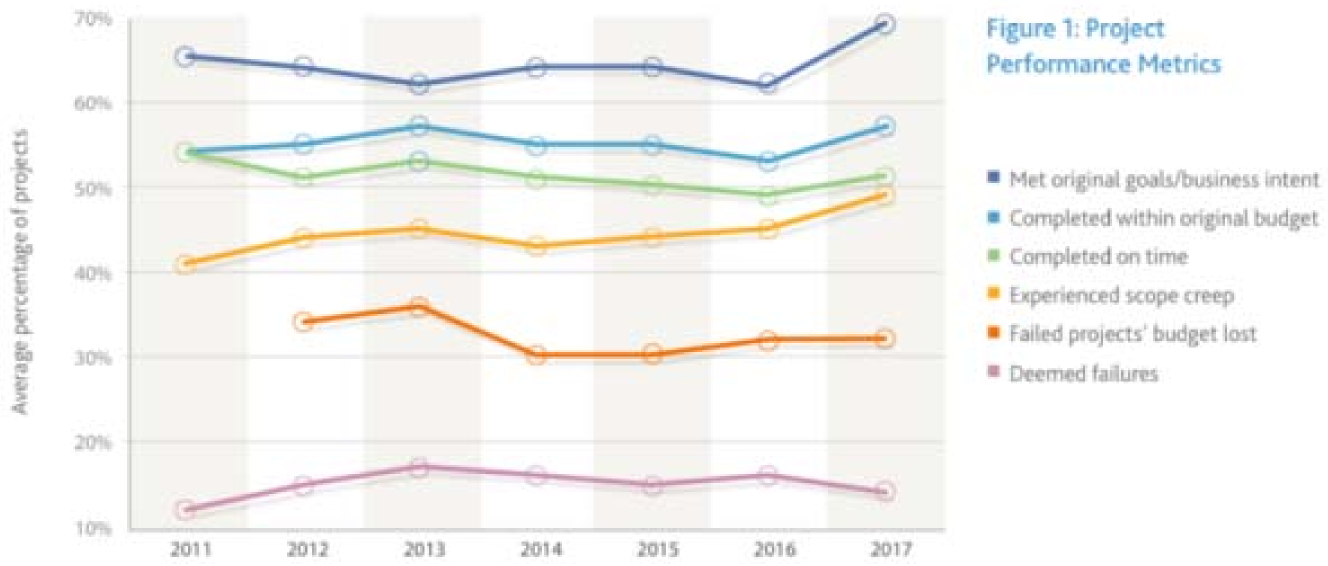


*Figure 1:*Project Performance Metrics. Reprinted from *PMI's Pulse of the Profession 9th Global Project Management Survey,* by Project Management Institute, 2017, retrieved from https://www.pmi.org/-/media/pmi/documents/public/pdf/learning/thought-leadership/pulse/pulse-of-the-profession-2017.pdf Copyright 2017 by Project Management Institute

PMI Study 2017

PMI produces an annual "Pulse of the Profession" report that includes survey results that were completed by those 3,000 diverse individuals throughout various industries. The results to a question around project failure were interesting. Below are the top 6 reasons respondents believe projects fail. These were the 2018 results and although not in the same order the top 6 results in 2015 included the same drivers.

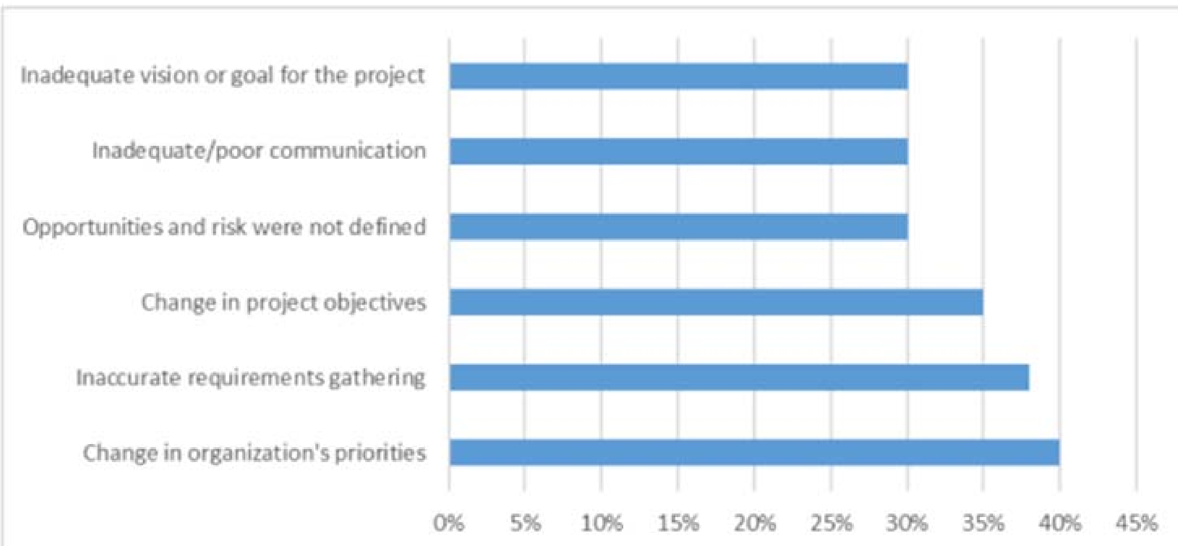


Figure 4: Appendix. Reprinted from *PMI's Pulse of the Profession 9th Global Project Management Survey*, by Project Management Institute, 2017, retrieved from https://www.pmi.org/-/media/pmi/documents/public/pdf/learning/thought-leadership/pulse/pulse-of-the-profession-2017.pdf Copyright

The WHYs of project “failures”

Cause	Business / Customer	Supplier	Comment / Solution
Poor user input	X	X	Training, time
Stakeholder conflicts	X	?	PM
Vague requirements	?	?	Terminology
Poor cost and schedule estimation	**?**	**X**	**Overly-optimistic, risk (avoidance)**
Skills that do not match the job	X	X	Training
Hidden costs of going "Lean and Mean“	X	X	Unrealistic goals, Resources
Failure to plan	?	?	Structure, PM
Communication breakdowns	X	X	Blame (He said, she said)
Poor architecture		X	
Late “failure” warning signals		X	Measurement

Loren May, CrossTalk editor
http://info.psu.edu.sa/psu/cis/biq/se501/a/a1/MajorCausesofSoftwareProjectFailures.pdf

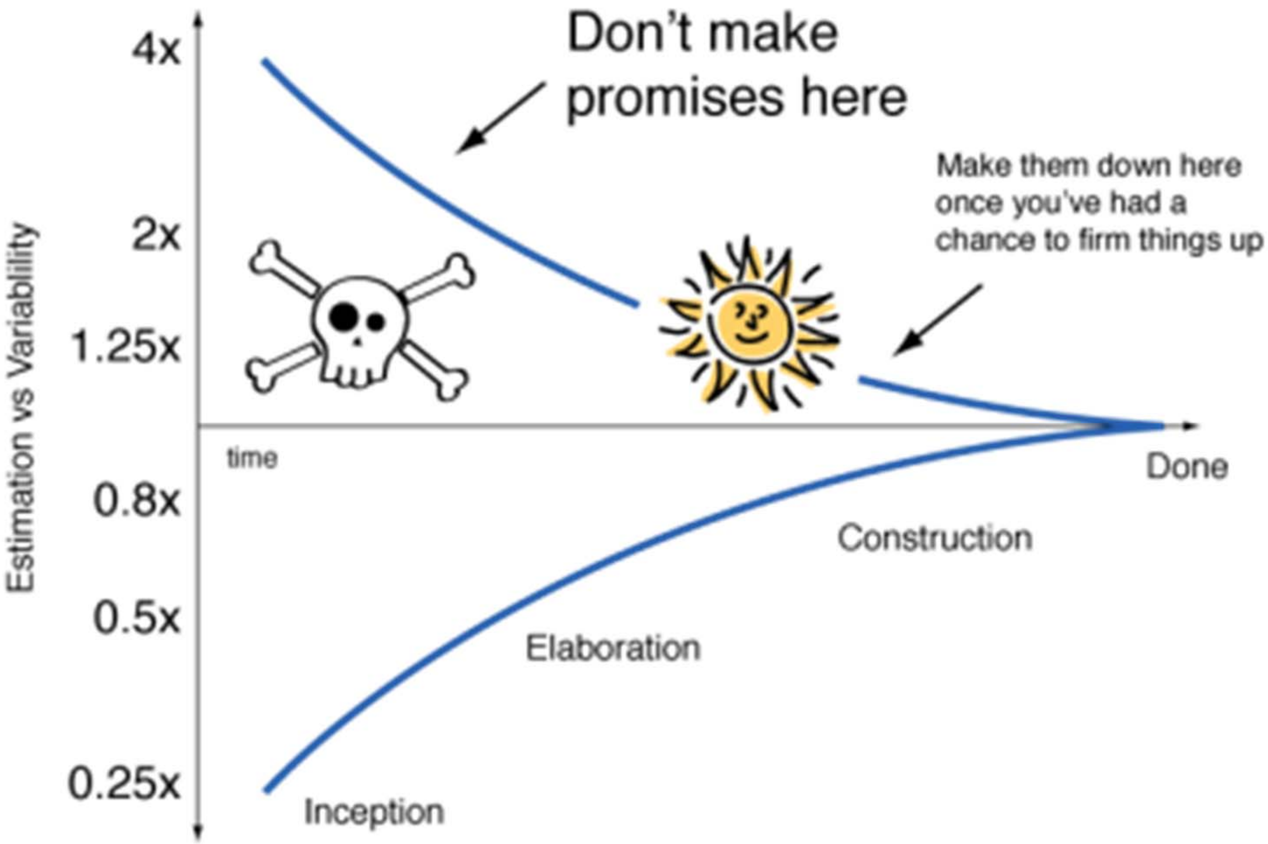
2018 CHAOS REPORT DEFINES CHAOS

- **C**OMPREHENSIVE **H**UMAN **A**PPRAISAL FOR **O**RIGINATING **S**OFTWARE
- HUMAN FACTORS AND HOW THEY IINFLUENCE PROJECT SUCCESS

CHAOS FACTORS OF SUCCESS

FACTORS OF SUCCESS	POINTS	INVESTMENT
Executive Sponsorship	15	15%
Emotional Maturity	15	15%
User Involvement	15	15%
Optimization	15	15%
Skilled Resources	10	10%
Standard Architecture	8	8%
Agile Process	7	7%
Modest Execution	6	6%
Project Management Expertise	5	5%
Clear Business Objectives	4	4%

Tom DeMarco: Any failure will be viewed as
a direct result of **underperformance**,
even though it is
"not even a significant factor"
in the failure of most projects…
failed projects had **goals… inherently unattainable.**



Software estimating poses unique challenges.

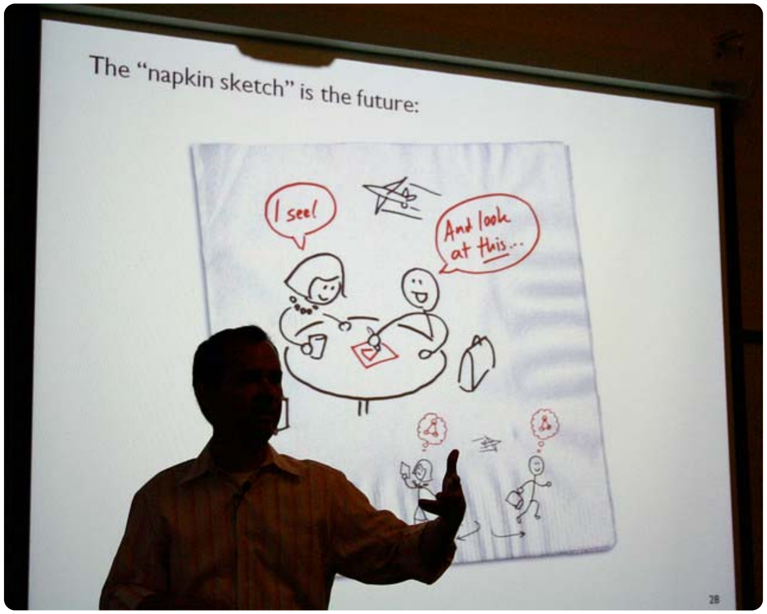
Uncertainties:

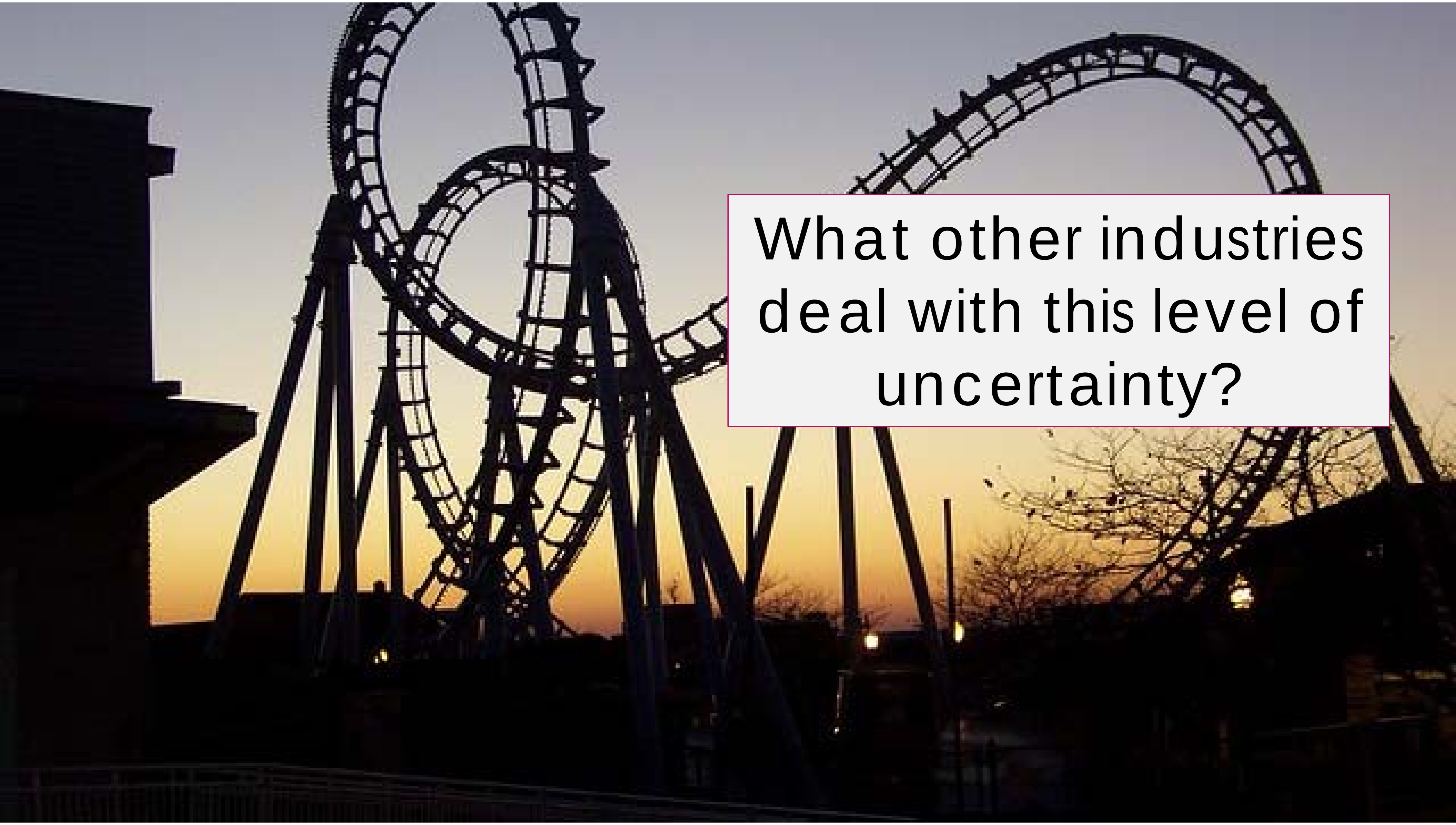
***Scope (size of software),**
Non-Functional Reqs,
Technical Complexity
Time (date driven)
Location
Team size
Rework (ambiguity)
Cost of status quo
Capability
+ Human Factors

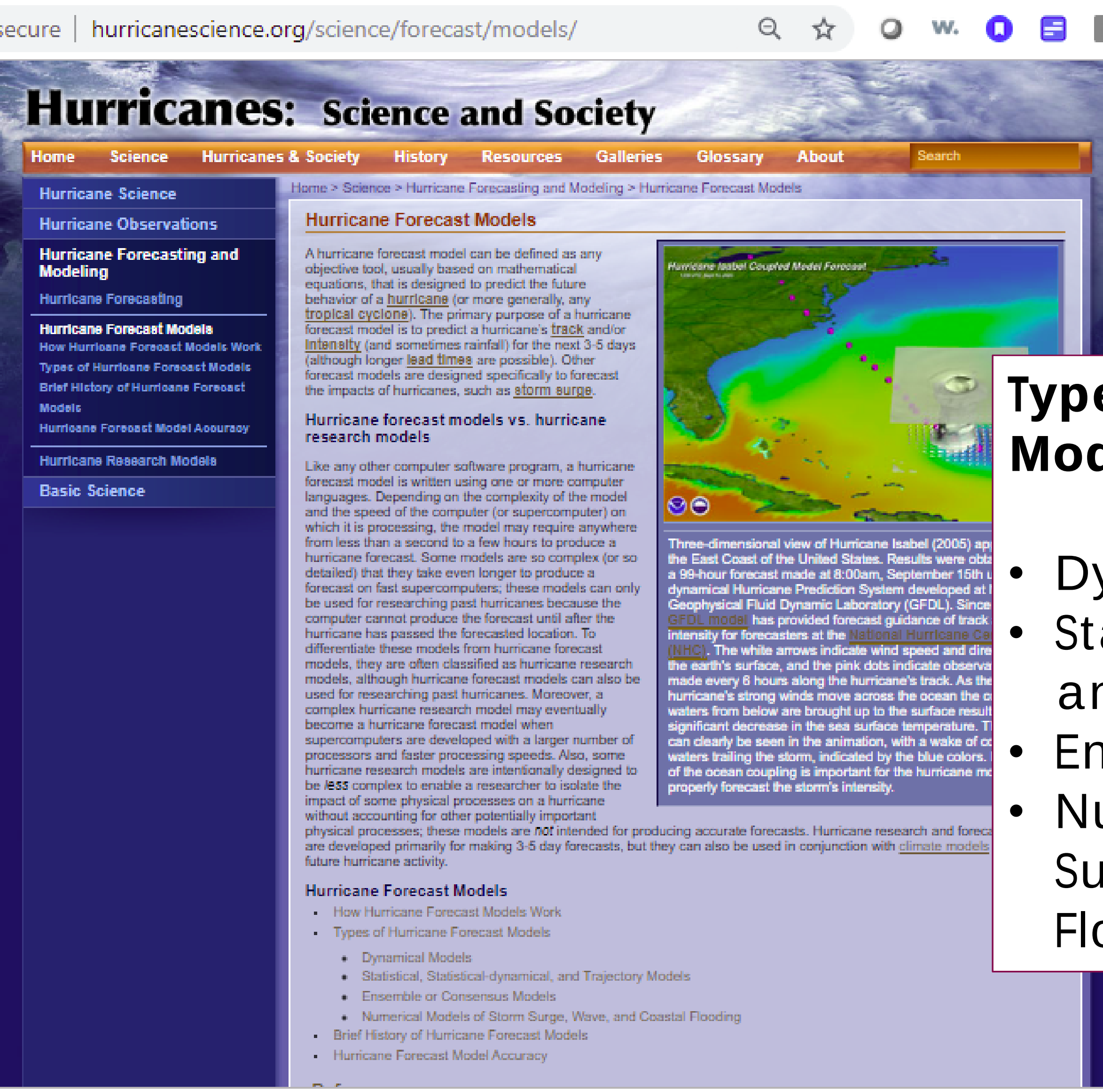
Back of the Napkin Estimating = Reality

Software Requirements → Ambiguous, (In)complete, Transparent, Intangible product(s)

Functional (what the software does) + Non-functional (how good) + Technical (how will we build)

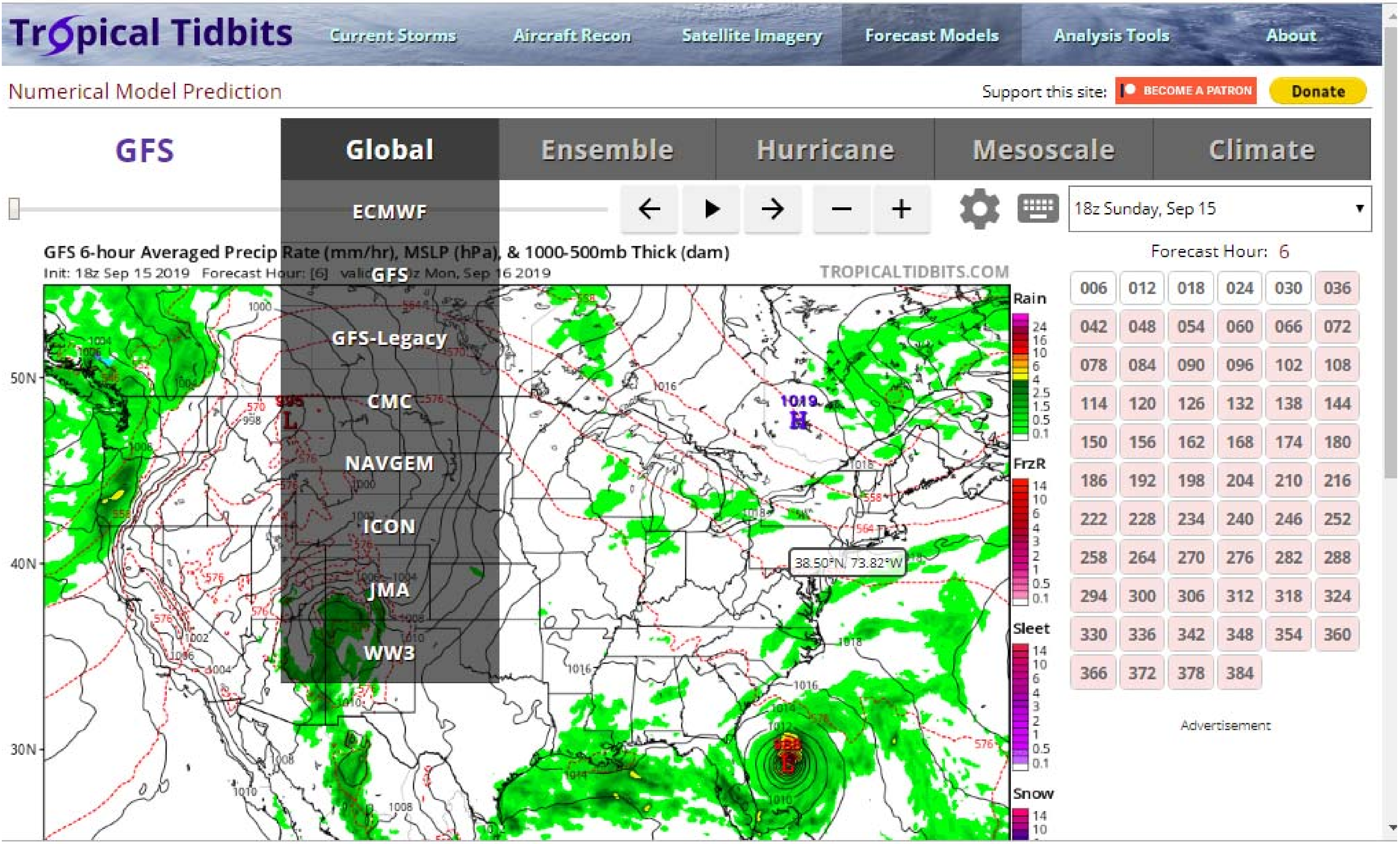



What other industries deal with this level of uncertainty?



Types of Hurricane Forecast Models:

- Dynamical Models
- Statistical, statistical dynamical, and trajectory models
- Ensemble or Consensus models
- Numerical models of Storm Surge, Wave and Coastal Flooding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CMC
NAVGEM
ICON
JMA
WW3
18z Sunday, Sep 15
GFS 6-hour Averaged Precip Rate (mm/hr), MSLP (hPa), & 1000-500mb Thick (dam)
Init: 18z Sep 15 2019 Forecast Hour: [6]
TROPICALTIDBITS.COM
Forecast Hour: 6
006 012 018 024 030 036
042 048 054 060 066 072
078 084 090 096 102 108
114 120 126 132 138 144
150 156 162 168 174 180
186 192 198 204 210 216
222 228 234 240 246 252
258 264 270 276 282 288
294 300 306 312 318 324
330 336 342 348 354 360
366 372 378 384
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Rain
FrzR
Sleet
Snow
50N
40N
30N
38.50°N, 73.82°W

NHC Track and Intensity Models

Climatology | Names | Wind Scale | Extremes | Models | Breakpoints

Updated 11 June 2019

The term "forecast model" refers to any objective tool used to generate a prediction of a future event, such as the state of the atmosphere. The National Hurricane Center (NHC) uses many models as guidance in the preparation of official track and intensity forecasts. The most commonly used models at NHC are summarized in the tables below.

Forecast models vary tremendously in structure and complexity. They can be simple enough to run in a few seconds on an ordinary computer, or complex enough to require a number of hours on a supercomputer. Dynamical models, also known as numerical models, are the most complex and use high-speed computers to solve the physical equations of motion governing the atmosphere. Statistical models, in contrast, do not explicitly consider the physics of the atmosphere but instead are based on historical relationships between storm behavior and storm-specific details such as location and date. Statistical-dynamical models blend both dynamical and statistical techniques by making a forecast based on established historical relationships between storm behavior and atmospheric variables provided by dynamical models. Trajectory models move a tropical cyclone (TC) along based on the prevailing flow obtained from a separate dynamical model. Finally, ensemble or consensus models are created by combining the forecasts from a collection of other models.

Table 1. Summary of global and regional dynamical models for track, intensity, and wind radii.

ATCF ID	Global/Regional Model Name	Horizontal Resolution	Vertical Levels and Coordinates	Data Assimilation	Convective Scheme	Cycle/Run Frequency	NHC Forecast Paramter(s)
NVGM/NVGI	Navy Global Environmental Model	Spectral (~31km)	60 Hybrid Sigma-pressure	NAVDAS-AR 4D-VAR	Simplified Arakawa Schubert	6 hr (144 hr) 00/06/12/18 UTC	Track and intensity
AVNO/AVNI GFSO/GFSI	Global Forecast System (FV3-GFS)	Finite Volume Cube Sphere (~13km)	64 Hybrid Sigma-pressure	GSI/4D-VAR EnKF hybrid	Simplified Arakawa Schubert	6 hr (240 hr) 00/06/12/18 UTC	Track and intensity
*EMX/EMXI/EMX2	European Centre for Medium-Range Weather Forecasts	Spectral (~9km)	137 Hybrid Sigma-pressure	4D-VAR	Tiedke mass flux	12 hr (240 hr) 00/12 UTC	Track and intensity
EGRR/EGRI/EGR2	U.K. Met Office Global Model	Grid point (~10 km)	70 Hybrid Sigma-pressure	4D-VAR Ensemble Hybrid	UKMET	12 hr (144 hr) 00/12 UTC	Track and intensity
CMC/CMCI	Canadian Deterministic Prediction System	Grid point (~25 km)	80 Hybrid Sigma-pressure	4D-VAR Ensemble Hybrid	Kain-Fritsch	12 hr (240 hr) 00/12 UTC	Track and intensity
HWRF/HWFI	Hurricane Weather Research and Forecast system	Nested Grid point (13.5-4.5-1.5km)	75 Hybrid Sigma-pressure	4D-VAR Hybrid GDAS GFS IC/BC	Simplified Arakawa Schubert + GFS shallow convection (6 and 18km) 1.5km nest - none	6 hr (126 hr) 00/06/12/18 UTC *Runs on request from NHC/JTWC*	Track and intensity
CTCX/CTCI	NRL COAMPS-TC w/ GFS initial and boundary conditions	Nested Grid point (45-15-5 km)	42 Hybrid Sigma-pressure	3D-VAR (NAVDAS) EnKF DART	Kain-Fritsch	6 hr (126 hr) 00/06/12/18 UTC *Runs commence on 1st NHC/JTWC advisory*	Track and intensity
HMON/HMNI	Hurricane Multi-scale Ocean-coupled Non-hydrostatic model	Nested Grid point (18-6-2km)	51 Hybrid Sigma-pressure	GFS IC/BC	Simplified Arakawa Schubert + GFS shallow convection (6 and 18km) 2km nest - none	6 hr (126 hr) 00/06/12/18 UTC *Runs on request from NHC/JTWC*	Track and intensity

Table 2. Summary of ensembles and consensus aids for track and intensity.

ATCF ID	Model Name or Type	Horizontal Resolution	Vertical Levels and Coordinates	Data Assimilation	Pertubation or Consensus Methods	Cycle/Run Frequency	Ensemble Members	NHC Forecast Paramter(s)
AEMN/AEMI	Global Ensemble Forecast System	~33 km for 1st 192 hr ~55 km for 192-384 hr	64 Hybrid Sigma-pressure	GSI/3D-VAR EnKF hybrid	20 of 80 6 hr DA system hybrid EnKF members per cycle	6 hr (384 hr) 00/06/12/18 UTC	20	Track
*UEMN/UEMI	U.K. Met Office MOGREPS	~20 km	70 Hybrid Sigma-pressure	4D-VAR EnKF hybrid	44 member EnKF	12 hr (168 hr) 00/12 UTC	11	Track
*EEMN/EMN2	ECMWF EPS	~18 km	91 Hybrid Sigma-pressure	4D-VAR	Leading singluar vectors based initial pertubations	12 hr (360 hr) 00/12 UTC	50	Track
*FSSE	Florida State Super Ensemble				Corrected consensus	6 hr (120 hr) 00/06/12/18 UTC		Track and Intensity
*HCCA	HFIP Corrected Consensus Approach				Cc cor	6 hr (120 hr)	AEMI AVNI CTCI	
*GFEX	2 model consensus				Simple			
TVCN (Atlantic) (TVCA)	Variable consensus				Simple mir m			
TVCN (E. Pacific) (TVCE)	Variable consensus				Simple mir m			
TVCX	Variable consensus				Simple mir memb weigl			
RVCN	Wind Radii Consensus				Multi- ra corre			
ICON	Intensity consensus				Simple all 4 p			
IVCN	Intensity variable consensus				Simple mir m			

* Public Access to these models is restricted due to agreements with the data provider.

Table 3. Summary of statistical models for track, intensity, and wind radii.

ATCF ID	Model Name or Type	Comments	Prediction Methodology	Cycle/Run Frequency	NHC Forecast Paramter(s)
CLP5 (OCD5)	CLIPER5 Climatology and Persistence	Used to measure skill in a set of track forecasts	Multiple regression technique. Inputs are current and past TC motion (previous 12-24hr), forward motion, date, latitude/longitude, and initial intensity	6 hr (120 hr) 00/06/12/18 UTC	Track
SHF5/DSF5 (OCD5)	Decay-SHIFOR5 Statistical Hurricane Intensity Forecast	Used to measure skill in a set of intensity forecasts, includes land decay rate component	Multiple regression technique using climatology and persistence predictors	6 hr (120 hr) 00/06/12/18 UTC	Intensity
TCLP	Trajectory-CLIPER	Used to measure skill in a set of track or intensity forecasts	Substitute for CLIPER and SHIFOR; similar predictors but uses trajectories based on reanalysis fields instead of linear regression	6 hr (168 hr) 00/06/12/18 UTC	Track and intensity
DRCL	Wind Radii CLIPER	Statistical parametric vortex model	Employs climatology with the paramaters determined from 13 coefficients and persistence to produce 34-kt, 50-kt, 64-kt wind radii estimates	6 hr (168 hr) 00/06/12/18 UTC	Wind radii
SHIP	Statistical Hurricane Intensity Prediction Scheme	Statistical-dynamical model based on standard multiple regression techniques	Climatology, persistence, environmental atmosphere parameters, and an ocean component	6 hr (168 hr) 00/06/12/18 UTC	Intensity
DSHP	Decay-Statistical Hurricane Intensity Prediction Scheme	Statistical-dynamical model based on standard multiple regression techniques	Climatology, persistence, environmental atmosphere parameters, oceanic input, and an inland decay component	6 hr (168 hr) 00/06/12/18 UTC	Intensity
LGEM	Logistic Growth Equation Model	Statistical intensity model based on a simplified dynamical prediction framework	A subset of SHIPS predictors, ocean heat content, and variability of the environment used to determine growth rate maximum wind coefficient	6 hr (168 hr) 00/06/12/18 UTC	Intensity

Early versus Late Models

Numerous objective forecast aids (guidance models) are available to help the NHC Hurricane Specialists in the preparation of their official track and intensity forecasts. Guidance models are characterized as either early or late, depending on whether or not they are available to the Hurricane Specialist during the forecast cycle. For example, consider the 1200 UTC (12Z) forecast cycle, which begins with the 12Z synoptic time and ends with the release of the official forecast at 15Z. The 12Z run of the NWS/Global Forecast System (GFS) model is not complete and available to the forecaster until about 16Z, or about an hour after the forecast is released – thus the 12Z GFS would be considered a late model since it could not be used to prepare the 12Z official forecast.

Multi-layer dynamical models are generally, if not always, late models. Fortunately, a technique can be used to take the latest available run of a late model and adjust its forecast to apply to the current synoptic time and initial conditions. In the example above, forecast data for hours 6-126 from the previous (06Z) run of the GFS would be adjusted, or shifted, so that the 6-h forecast (valid at 12Z) would exactly match the observed 12Z position and intensity of the tropical cyclone. The adjustment process creates an "early" version of the GFS model for the 12Z forecast cycle that is based on the most current available guidance. The adjusted versions of the late models are known, for historical reasons, as interpolated models.

Interpreting Forecast Models

NHC provides detailed information on the verification of its past forecasts with a yearly verification report (https://www.nhc.noaa.gov/verification/verify3.shtml). On average, NHC official forecasts usually have smaller errors than any of the individual models. An NHC forecast reflects consideration of all available model guidance as well as forecaster experience. Therefore, users should consult the official forecast products issued by NHC and local National Weather Service Forecast Offices rather than simply look at output from the forecast models themselves. Users should also be aware that uncertainty exists in every forecast, and proper interpretation of the NHC forecast must incorporate this uncertainty. NHC forecasters typically discuss forecast uncertainty in the Tropical Cyclone Discussion (TCD) product. NHC also prepares probabilistic forecasts that incorporate forecast uncertainty information (https://www.nhc.noaa.gov/aboutnhcprobs.shtml).

NOAA/NWS Models

The National Weather Service produces some of the models used by the National Hurricane Center. These models are run by NOAA/NWS National Centers for Environmental Prediction (NCEP) Central Operations (NCO). Output images from the NOAA/NWS models can be found through NCEP's Model Analyses and Guidance (MAG) interface. Raw data from the models can be found through the NOAA Operational Model Archive and Distribution System (NOMADS).

Other model background Information

Read about the Inland Wind Model and the Maximum Envelope Of Winds

Essentially = Inverse of the Software Estimation Cone of Uncertainty

NOTE: How many models are used?

Hurricane Forecast Computer Models

By Dr. Jeff Masters, Director of Meteorology

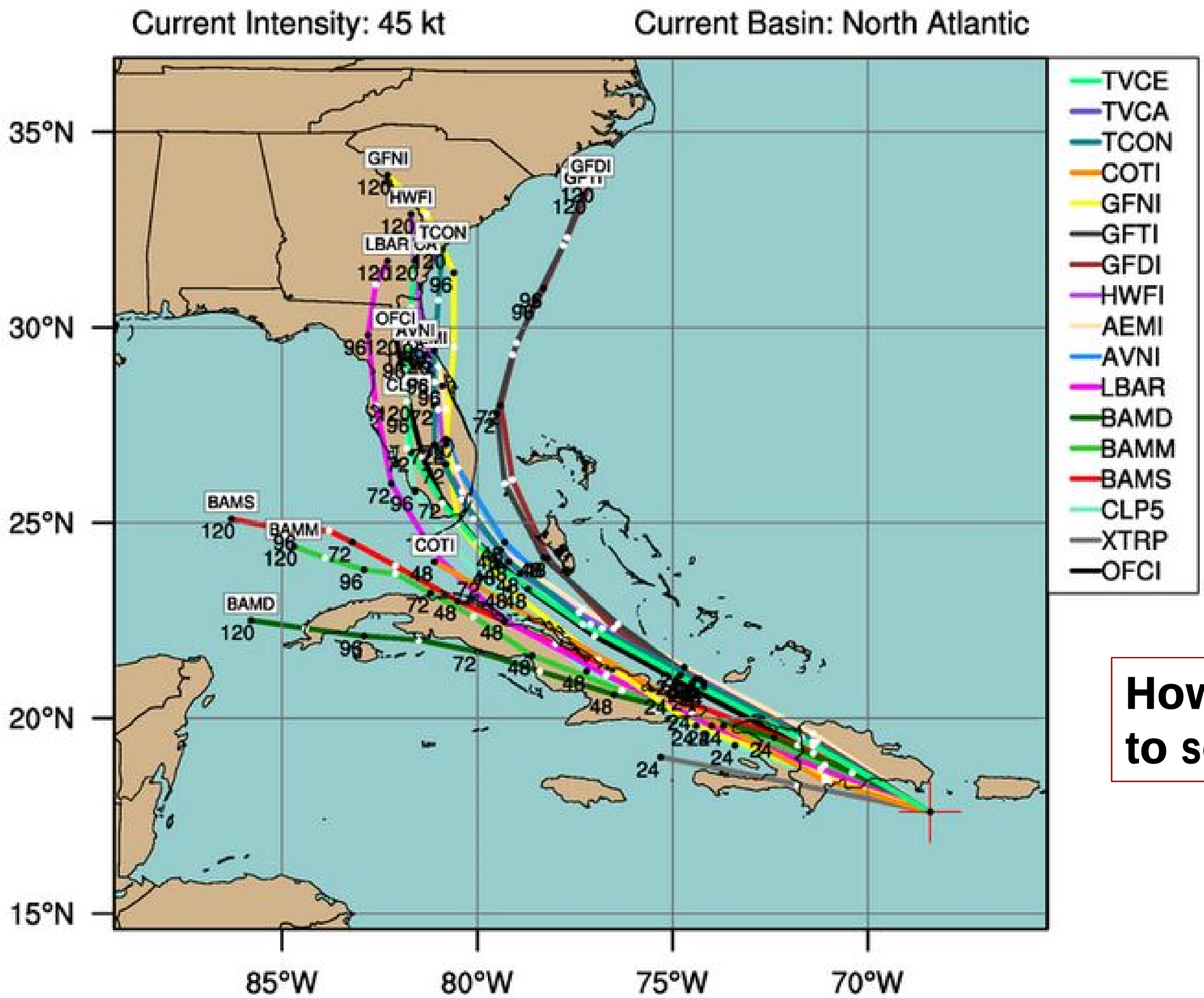
The behavior of the atmosphere is governed by physical laws which can be expressed as mathematical equations. These equations represent how atmospheric quantities such as temperature, wind speed and direction, humidity, etc., will change from their initial current values (at the present time). If we can solve these equations, we will have a forecast. We can do this by sub-dividing the atmosphere into a 3-D grid of points and solving these equations at each point.

These models have three main sources of error:

1) Initialization: We have an **imperfect description** of what the atmosphere is doing right now, due to lack of data (particularly over the oceans). When the model starts, is has **an incorrect picture of the initial state of the atmosphere, so will always generate a forecast that is imperfect.**

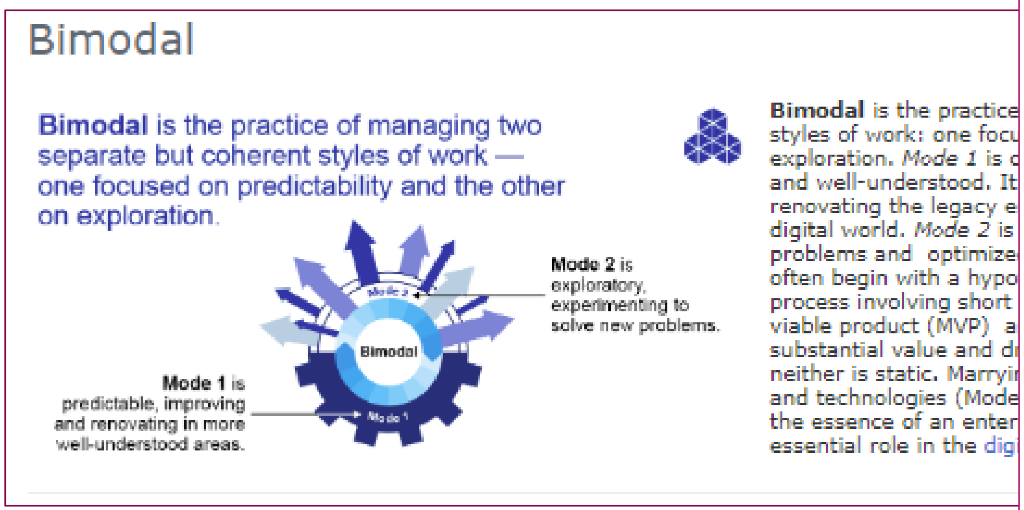
2) Resolution: Models are run on 3-D grids that cover the entire globe. Each grid point represents of piece of atmosphere perhaps 40 km on a side**. Thus, processes smaller than that (such as thunderstorms) are not handled well and must be "parameterized". This means we make up parameters (fudge factors) that do a good job giving the right forecast most of the time. Obviously, the fudge factors aren't going to work for all situations.**

3) Basic understanding: Our basic understanding of the physics governing the atmosphere is imperfect**, so the equations we're using aren't quite right.**



How can we apply this to software estimating?

Interesting idea…



Gartner Research

How to Size and Estimate Applications in a Bimodal World

Published: 10 March 2017

ID: G00308855

Analyst(s): Mike Gilpin , Matthew Hotle

Summary

In many firms, the work of sizing and estimating software delivery is a dysfunctional game. Application leaders can avoid this dysfunction by adopting better sizing and estimating practices. As enterprise agile becomes more common, firms must employ different practices for different styles of work.

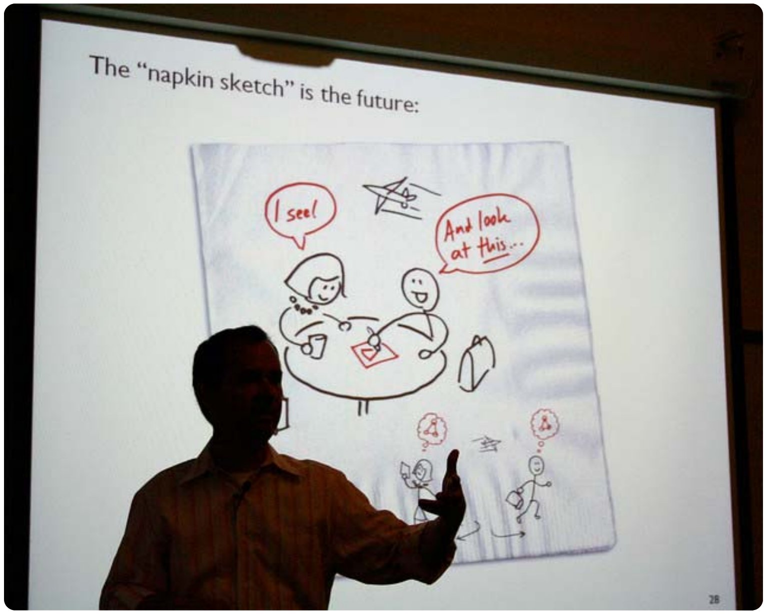
Table Of Contents

Back of the Napkin Estimating = (Sizable) Reality

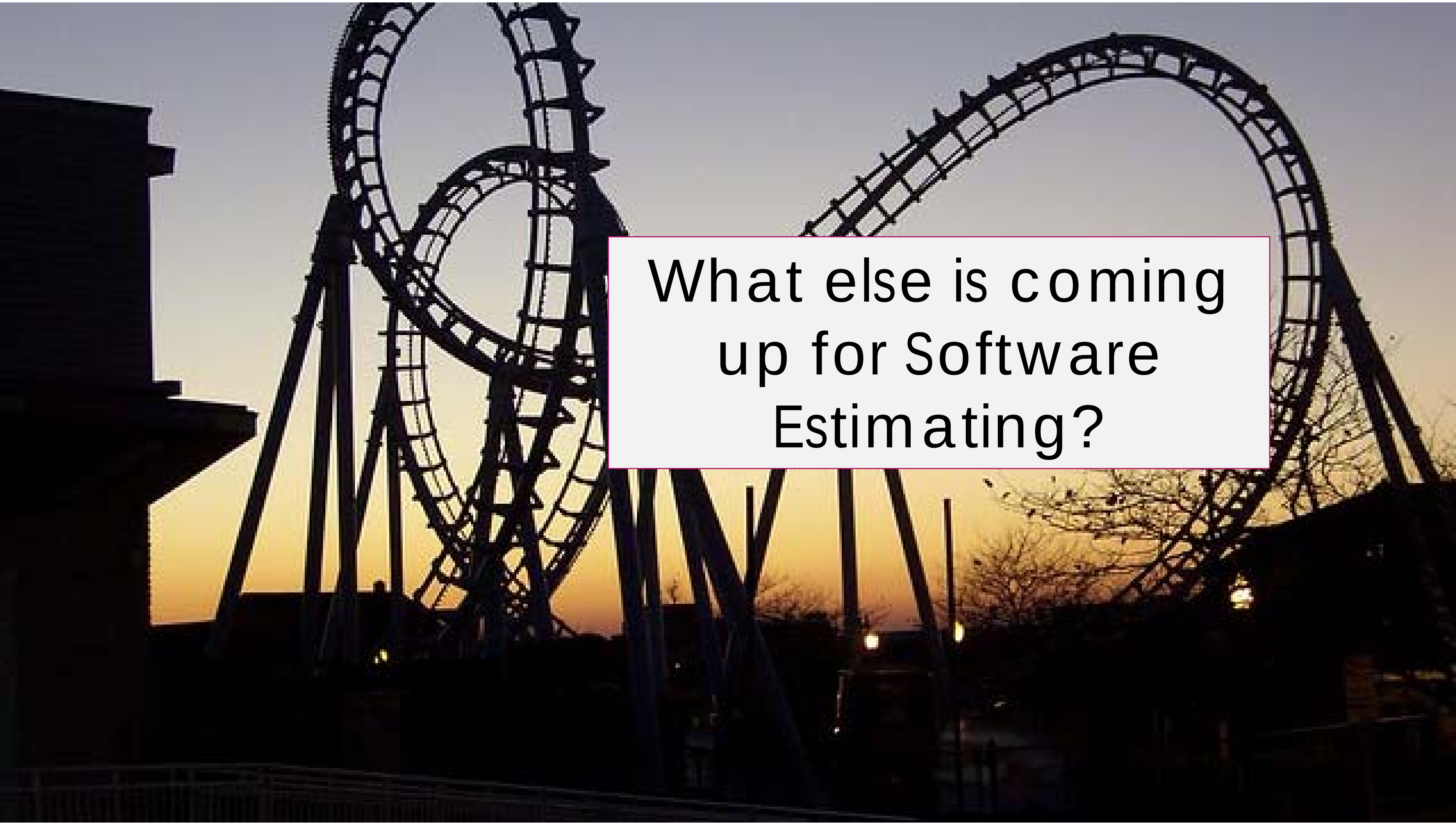
Functional (**estimated Functional Size**)
+ Non-functional (**estimated NFSize**)
+ Technical (**parameters**)

Software Requirements → Ambiguous, (In)complete, Transparent, Intangible product(s) …… **IEEE Completeness Checklist**

USE MULTIPLE MODELS (Parametric + Analogy +)



What else is coming up for Software Estimating?



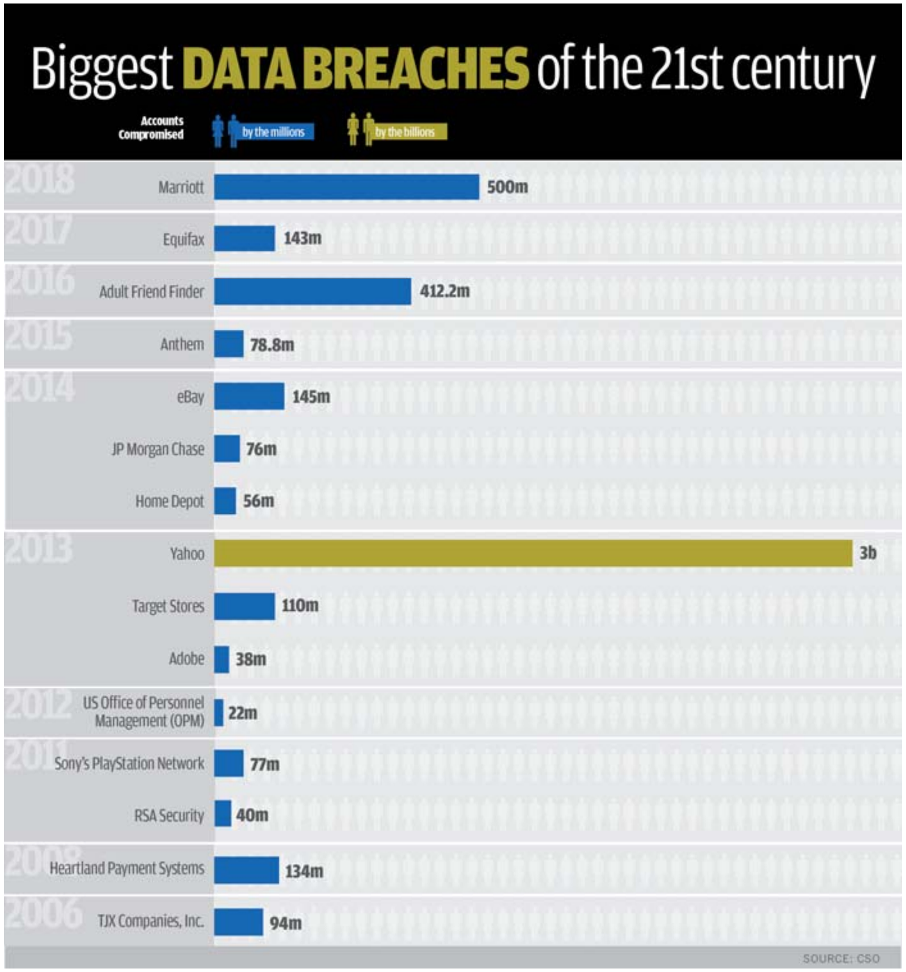
Increasing cyber security = $ $ $

Data

Privacy

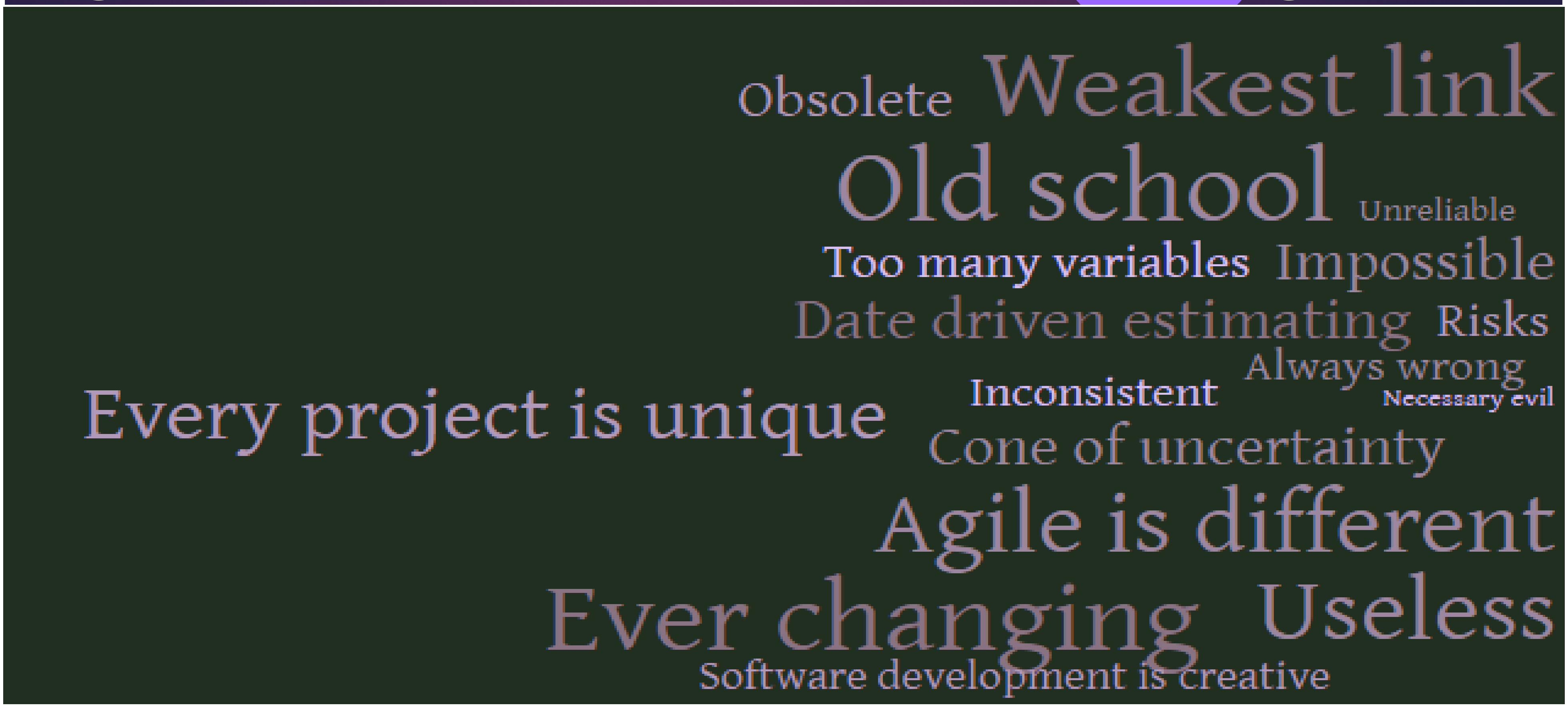
GDPR

= $ $ $



“Agile changes everything…”

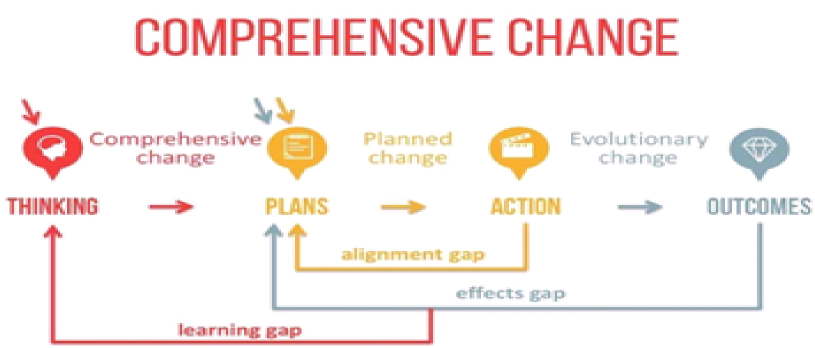
Agilist Views of Software Estimating



Agile embraces early failure...

Martin Aziz
Director; Projects & Agile Practices CoE at...
5d

In his Lean Kanban India webinar Patrick Steyaert talks about Business Agility being beyond practices. On feedback loops: Most agile adoptions miss the "learning gap" #kanban #agile #systemsthinking



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Closing paragraph of 1995 Standish Group Chaos Report:

There is one final aspect to be considered in any degree of project failure. All success is rooted in either luck or failure. If you begin with luck, you learn nothing but arrogance.

However, if you begin with failure and learn to evaluate it, you also learn to succeed. Failure begets knowledge. Out of knowledge you gain wisdom, and it is with wisdom that you can become truly successful.


expectations.
Business value added
Stakeholder ROI
DevOps
Digital transformation
Different but same
as I’m used to
UX

New topics...

September 11, 2019, 5:00 AM EDT

DNA Company Tampered With Results, Former Employees Say

- Seventeen people who used to work for Orig3n say its test kits sometimes failed to work as advertised and were often contaminated or otherwise inaccurate.

By Kristen V Brown

ILLUSTRATION: WENKAI MAO FOR BLOOMBERG BUSINESSWEEK

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About three years ago, Orig3n Inc., a small genetic

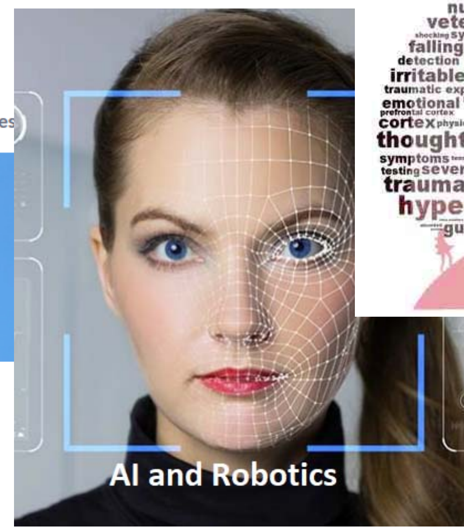
Home > General > Key Words

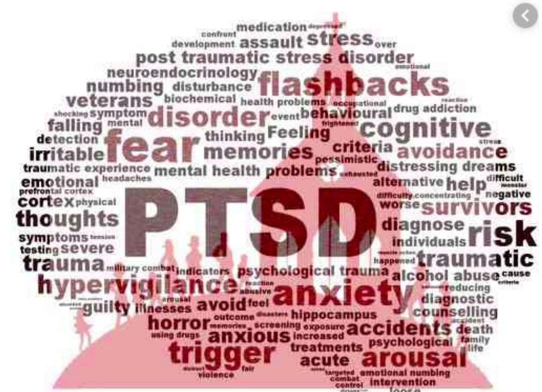
GET EMAIL ALERTS

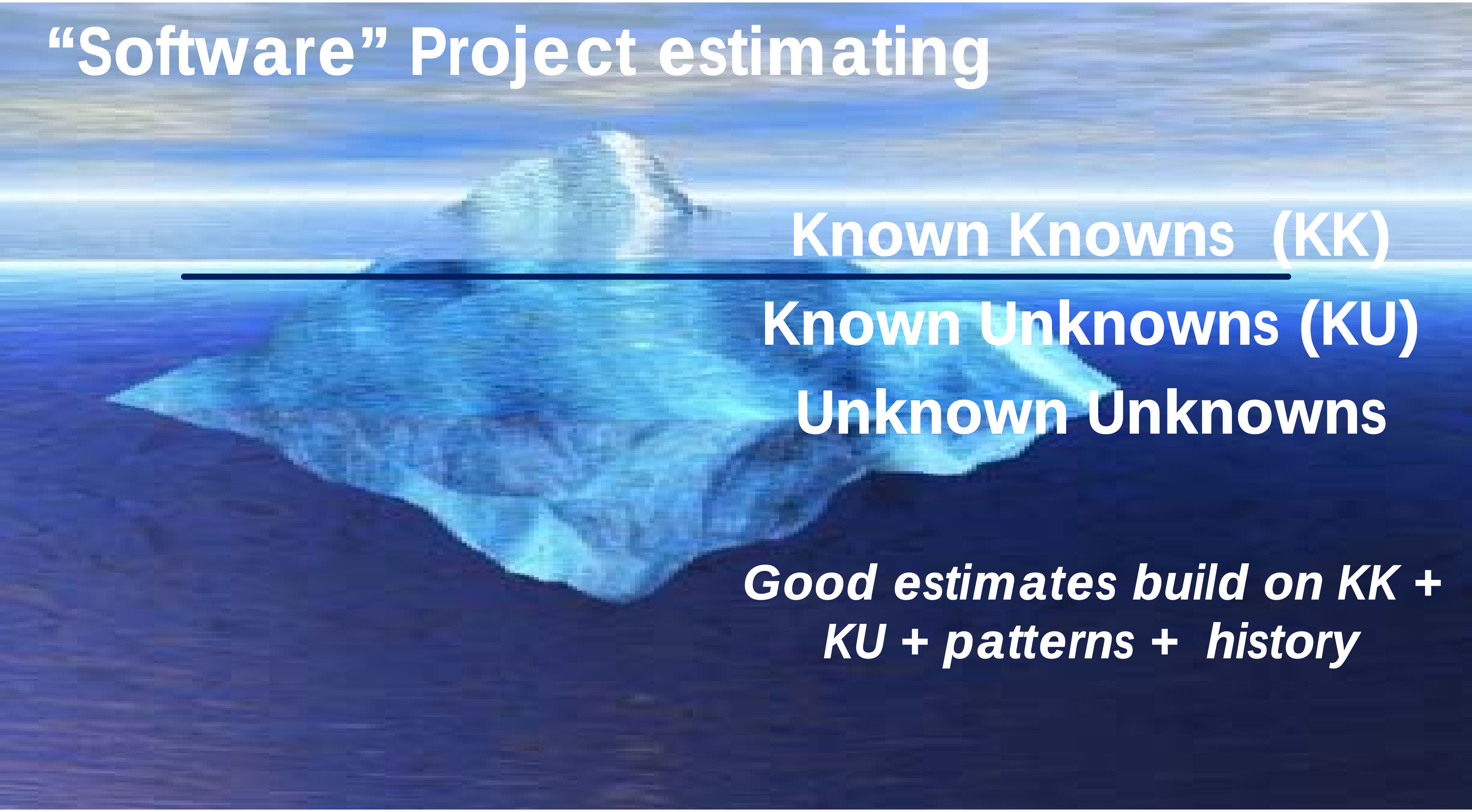
Alibaba's Jack Ma calls the '996' — China's 72-hour workweek — a 'huge blessing'

Published: Apr 15, 2019 1:22 p.m. ET

The extreme overtime culture at many Chinese tech companies



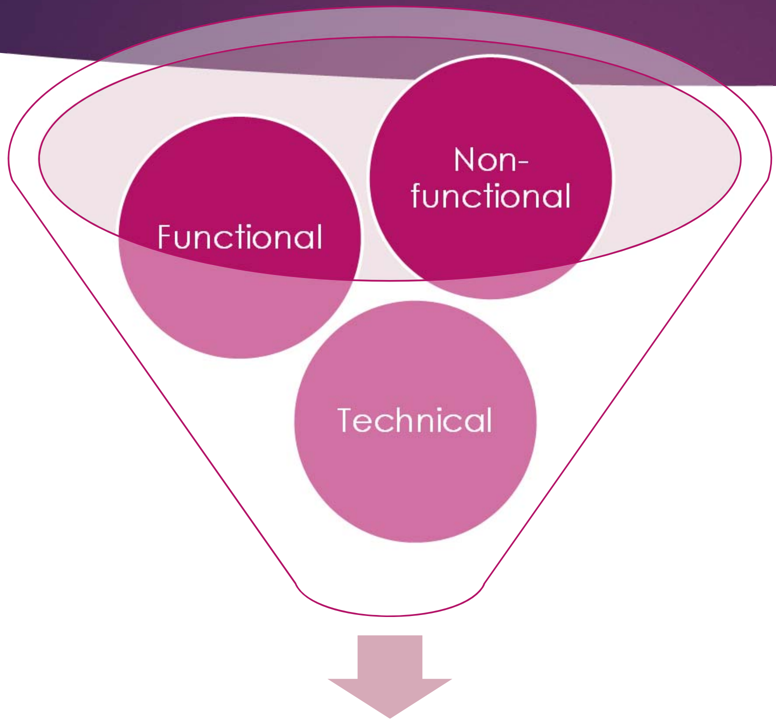



“Software” Project estimating
Known Knowns (KK)
Known Unknowns (KU)
Unknown Unknowns
Good estimates build on KK +
KU + patterns + history

Software Cost Estimation Iceberg

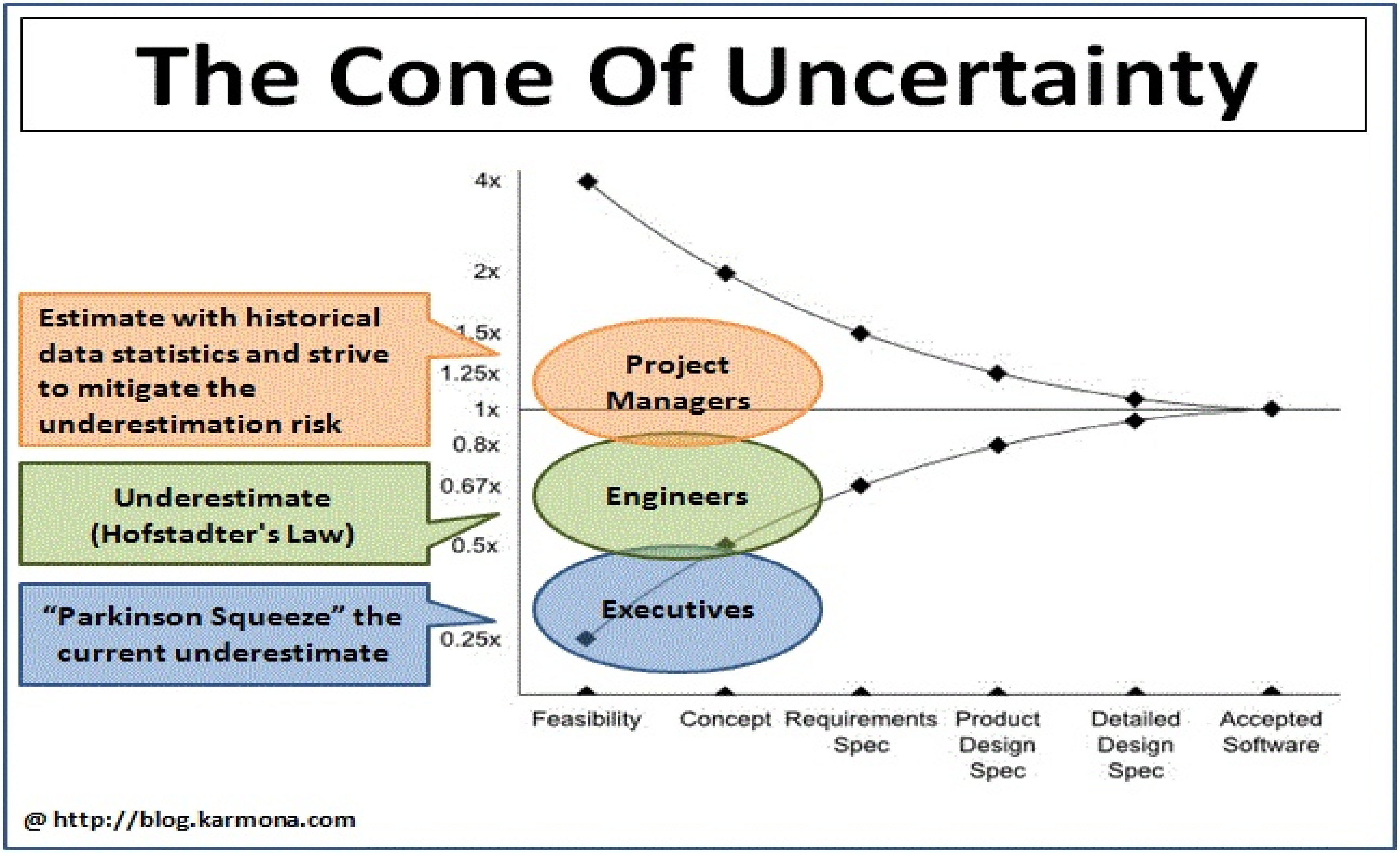
- Make the best decision (go, no go, conservative estimate) based on:
  - Known knowns (known requirements, constraints, what’s on the table)
  - Known unknowns (history & calibrated models)
  - Unknown unknowns (historical risks, contingency)

Use Multiple Software Cost Estimating models



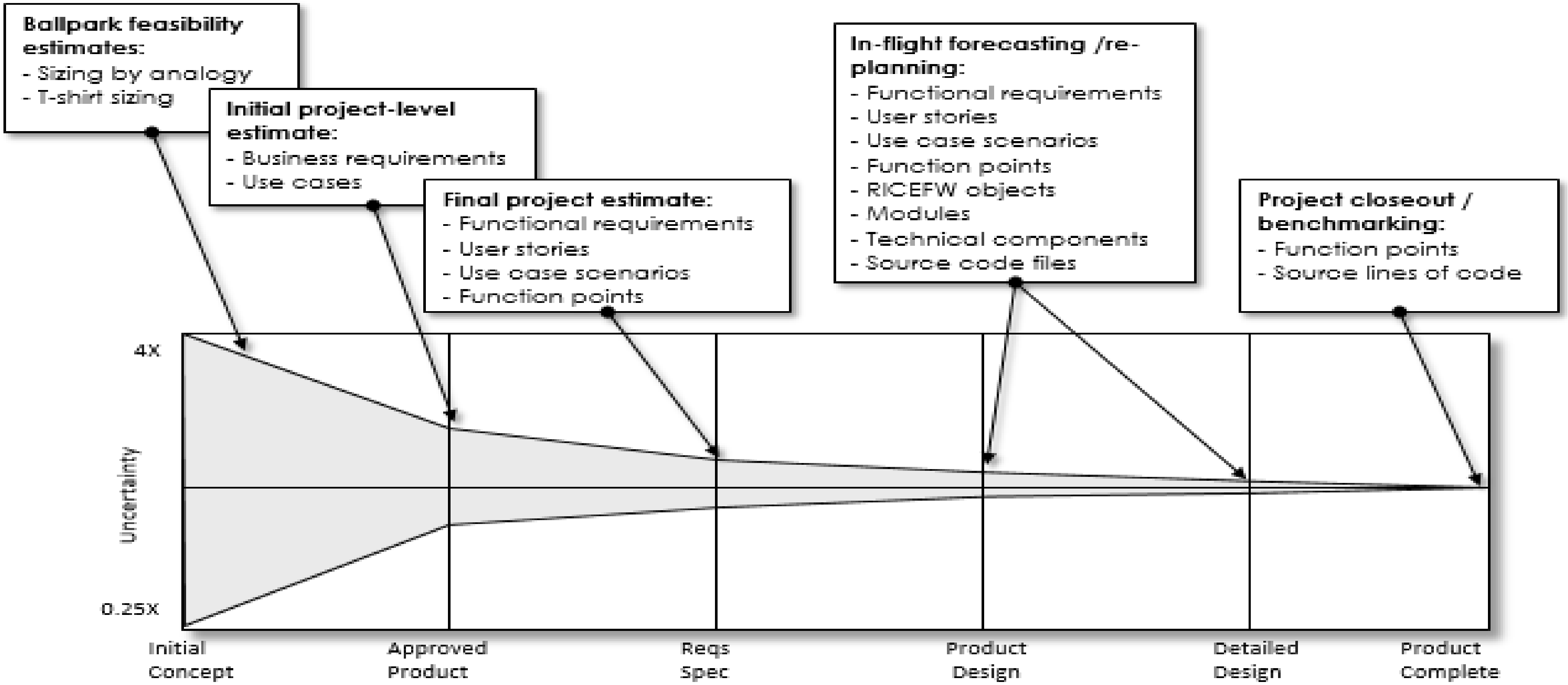
Estimate (cost, effort, schedule)

- Micro
- Macro
- Combination
- Parametric
- Non-linear
- Non-trivial
- Analogous
- History


The Cone Of Uncertainty
4x
2x
1.5x
1.25x
1x
0.8x
0.67x
0.5x
0.25x
Estimate with historical data statistics and strive to mitigate the underestimation risk
Underestimate (Hofstadter's Law)
"Parkinson Squeeze" the current underestimate
Project Managers
Engineers
Executives
Feasibility
Concept
Requirements Spec
Product Design Spec
Detailed Design Spec
Accepted Software
@ http://blog.karmona.com

Sizing Methods Used at Various Stages of the Software Development Life Cycle

The sizing method used should be based on available information and where you are in the software development life cycle vs. the "Cone of Uncertainty."



sCEBOK S/W Cost Estimating Overview

- Key Ideas
  - Cost Drivers
    - Size
    - Complexity
    - Capability
  - SLOC vs. ESLOC vs. Function Points
  - Development Methodologies

- Practical Applications
  - ESLOC Sizing
  - Software Effort Calculation
    - Capability Adjustments
    - Complexity Adjustments
  - Schedule Determination
  - Schedule Compression Factors

- Analytical Constructs
  - ESLOC Equation
  - COCOMO II CER Equation

$$PM = A \cdot Size^E \cdot \prod_{i=1}^{n} EM_i$$

  - COCOMO II Schedule CER

- Related Topics
  - Costing Techniques 2
  - Parametric Estimating 3
  - Regression Analysis 8

sCEBOK

- Software is a key component of almost every system including:
  - Custom Developed Software
  - Commercial-Off-The-Shelf (COTS) Software
  - Databases
  - Enterprise Resource Planning (ERP) Tools
- Software development is both an art and a science, as is estimating software development
- Using equations from COCOMO II developed by Barry Boehm in many of the examples
  - Leader in field of software cost estimation
  - Research publicly available in texts

Challenges in Estimating Software

- System Definition
- Sizing and Tech
- Quality
- COTS
- Calibration
- Databases
- Growth and Demand

Cost Drivers – Size

- **<u>Size</u> is the primary cost driver of software development costs**
- **Methods of measuring size include**
  - Source Lines of Code (SLOC)
    - Equivalent Source Lines of Code (ESLOC)
  - Function Points
  - Object Points

A good assessment of size is critical to a good estimate!

Software Cost Estimating Summary – Communication is Key

- Understanding software cost estimation is critical because software is part of almost every estimate
- Software cost estimating is in many ways similar to hardware estimating
- There are a variety of software development approaches that can affect development cost and must be modeled accordingly to estimate
- Analogy and Parametric are commonly used to estimate software development costs
- There are a number of commercial parametric models available to estimate software costs
- Software provides a number of specific challenges for the estimator
- Communicate with ranges and bands of uncertainty

Thank you…

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