Where Next?

Some Musing on the Future of Software Architecture

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Lots has been achieved

- 20+ years has seen great advancements in software architecture:
  - Methods
  - Processes
  - Design tools/modeling
  - Frameworks
  - Best practices/patterns
  - Standards

But are we running out of steam?

- Many incremental improvements over last 5 years
- Any really exciting innovations in our field:
  - In research?
  - In practice?
- Are these addressing the growing complexity and scale of systems?
  - Hmmm…

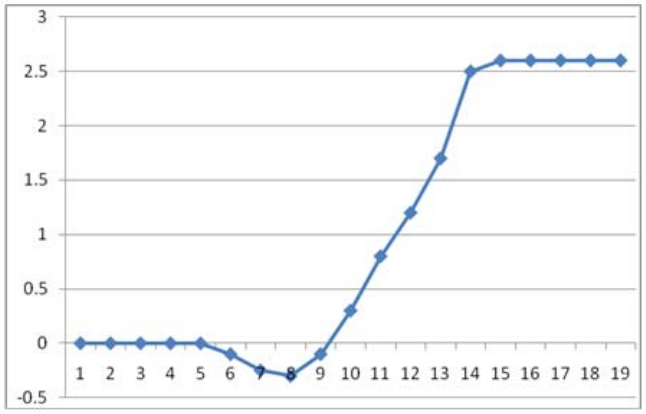
Becoming Quantitative …

- Qualitative = ‘touchy feely’
- Need quantitative methods/tools for architecture analysis and design, e.g.
  - Assessing design alternatives
  - Buy versus Build
  - Cost/effort estimate predictions from architecture models
  - Performance/scalability predictions from architecture models
- Many numerical methods exist that could be exploited:
  - Uncertainty quantification
  - Sensitivity analysis
  - Decision theory (e.g. AHP)
  - Regression
  - Error analysis

But isn't Quantification hard?

- Yup - but it doesn't stop others …
- Climate models
  - Simulations typically 'calibrated' to produce outputs that match reality (ie historical data)
  - They 'adjust' for 'bias' in models
  - Much still unknown about the physics/chemistry of climate at a global scale
- We need concerted R&D to move software architecture to more quantitative foundations
  - Models
  - Methods
  - Tools

```
;
; Apply a VERY ARTIFICAL correction for decline!!
;
yrloc=[1400,findgen(19)*5.+1904]
valadj=[0.,0.,0.,0.,0.,-0.1,-0.25,-0.3,0.,-0.1,0.3,0.8,1.2,1.7,2.5,2.6,2.6,
2.6,2.6,2.6]*0.75 ; fudge factor
if n_elements(yrloc) ne n_elements(valadj) then message,'Oooops!'
yearlyadj=interpol(valadj,yrloc,timey)
```



And we need to Study Scale (Ultra Large Systems)

- Size of systems is growing rapidly, e.g:
  - Smart grid
  - Internet-scale applications
  - Scientific data repositories
  - Internet of Things/Sensor networks
- Scaling stresses everything
  - Design, Development
  - Deployment, Evolution
- Building Internet Scale systems remains very much a 'black art'
  - Something the software architecture community is well positioned to address?
  - Approaches must combine both design and technology, reaching down the various technology stacks
  - http://highscalability.com/ is a great read

"Twitter alone generates more than 7 terabytes of data every day, Facebook 10 TB..."

Summary …