Is the Goal of Self-adaptive Systems Full Automation?

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AC Formative Years: IBM Perspective*

*Kephart, AC keynote, 2011

- 9 AC FAs awarded by Research
- Start contacting universities
- University Days: UK, Germany, France
- Ga Tech equipment grant, 2 Toronto CAS awards
- 13 FAs, 2 SURs
- 25 profs supported via FA, CAS, equipment grant, IIG, etc.
- 15 profs supported via FA, CAS, SUR, etc.

- 2001
  - AC Manifesto
  - AC Vision papers (IEEE Computer, IBM Sys Journal)
- 2002
  - AASMS03 (FCRC)
  - AMS03 (HPDC)
  - 5 AC workshops
  - 2 AC journals
- 2003
  - IJCAI 03 Wkshop on AC & AI
  - 26 AC confs/wkshops
  - 2 AC journals
- 2004
  - ICAC04
  - 30 AC confs/wkshops
  - 3-4 AC journals
- 2005
  - ICAC05, SelfMan05
  - WRAC05
  - ICAC06, HotAC06, SelfMan06
  - Latin American AC Symposium
  - >40 AC confs/wkshop
  - >4 AC journals
- 2006
  - DEAS
  - SEAMS
We Lost the Human in the Loop!!

- In the early phase of AC, Human Interaction Studies topic was present
- At DEAS 2005, we had a session on “Interactions”
- In ICAC community, “human interaction studies, never prevalent, became extinct in 2006”*
- At SEAMS, after 2006, human interactions studies became (almost) extinct
- What is the risk?

Jeff Kephart, ICAC 2011
Model Predictive Optimization: Simplified View

\[
\begin{align*}
\text{minimize } & \quad E \left[ \sum_{t=1}^{T} \sum_{c=1}^{C} \lambda_{\text{SLA}} (R_{c,t} - R_{c}^{\text{SLA}}) + \sum_{t=1}^{T} \sum_{h=1}^{H} \lambda_{\text{resource},h} (U_{h,t}) + \sum_{t=1}^{T} \sum_{h=1}^{H} \sum_{s=1}^{S} \lambda_{\text{dep}} (\theta_{s,h,t}, \theta_{s,h,t-1}) \right] \\
\text{subject to: } & \quad R_{t} = \text{LQM}_{\Omega,\sigma}(d_{t}, \theta_{t}, W_{t}) \quad \forall t \\
& \quad \sum_{h=1}^{H} \theta_{s,h,t} = 1 \quad \forall s, t 
\end{align*}
\]

- I delegate the financial/investment decisions, procurement, trade-off analysis, forecasting, etc., to an unsupervised program.
- This breaches most companies policies.
Towards a Human Centric MAPE-K Loop

- Consider the users
  - Operations teams
  - Developers

- Add the “K” back to the MAPE loop

OpenStack
Industry Trends: DevOps

- **DevOps**: promotes the idea of strong collaboration among Development and Operations teams
- **NoOps** means developers can code, deploy, manage and maintain the application
  - automated systems (PaaS like Cloud Foundry, BlueMix) manage app lifecycles; no Operations teams
- **Adaptation** is one of the main aspects of DevOps/Noops