Gap and Expectations in Dependability

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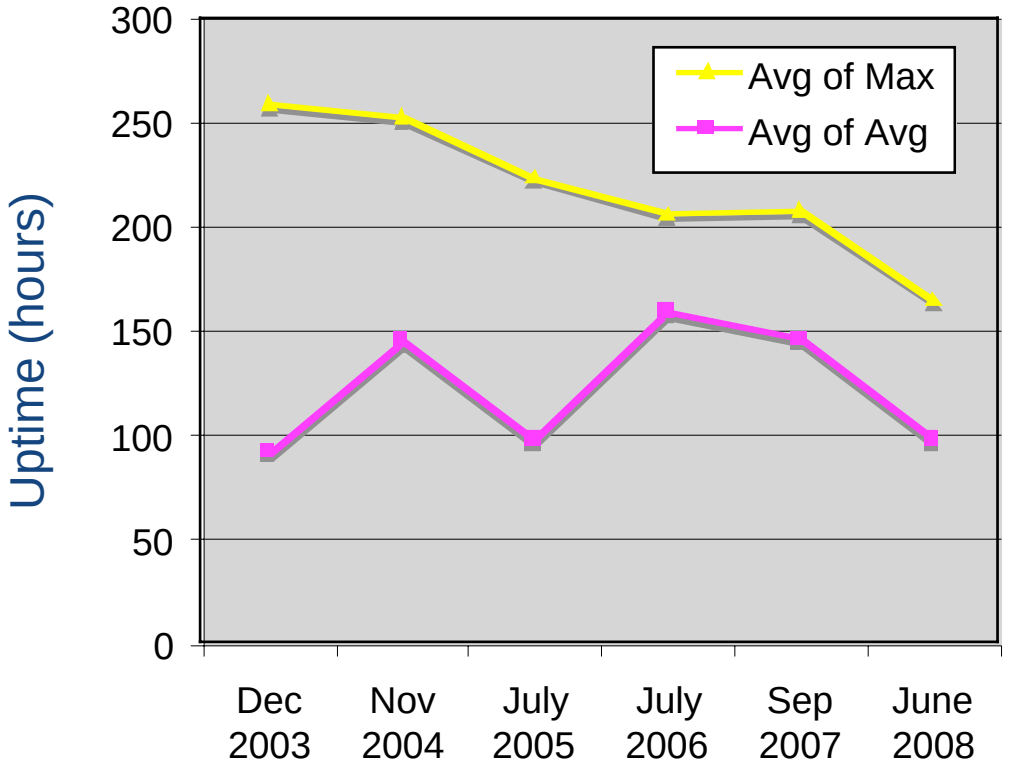
Website uptime statistics (Netcraft)

Top 50 most requested sites



Availability for 100h MTBF

MTTR	Availability
1 min	99.98
10 mins	99.83
1 hour	99.01
8 hours	98.59

Three large websites [from D. Oppenheimer, A. Ganapathi, D.A. Patterson, 'Why do Internet services fail, and what can be done about it?', USISTS '03]

Website		*Online* (mature)	*Readmostly* (mature)	*Content (bleeding edge)*
Service characteristic	Hits per day	~100 million	~100 million	~7 million
	# of machines	~500, 2 sites	>2000, 4 sites	~500, ~15 sites
	Front-end node architecture	Solaris on SPARC and x86	Open-source OS on x86	Open-source OS on x86
	Back-end node architecture	Network Appliance filters	Open-source OS on x86	Open-source OS on x86
	Period of data stud.	7 months	6 months	3 months
	Component failures	296	N/A	205
	Service failures	40	21	56
	MTTF	126 hours	206 hours	39 hours
Service failure cause by location	Front-end	77%	0%	66%
	Back-end	3%	10%	11%
	Network	18%	81%	18%
	Unknown	2%	9%	4%
Average TTR by part of service (hrs)	Front-end	9.4 (16 serv. fai.)	N/A	2.5 (10 serv. fai.)
	Back-end	7.3 (5 serv. fai.)	0.2 (1 serv. fai.)	14 (3 serv. fai.)
	Network	7.8 (4 serv. fai.)	1.2 (16 serv. fai.)	1.2 (2 serv. fai.)
Average availability		93.5%	97.2%	97.8%

- Three order of magnitude drop wrt traditional high availability computing systems, e.g., Tandem or IBM high end servers
- Worrying situation as large websites foreshadow a significant part of future ubiquitous systems

☞ Society problem

- In order to effectively support the knowledge society, the information infrastructure has to become a commodity as are other essential infrastructures, such as electricity, water, fixed phone, which exhibit at least five 9s availability
- Coexistence of five 9s infrastructures with a two 9s infrastructure, which, futhermore, is supposed to support the former ones?

Expectations of colleagues from other communities

- 50th anniversary issue of Communications of the ACM (January 2008): most of the articles point at dependability or resilience as a major concern (Jeannette Wing, Rodney Brooks, Gul Agha, John Crowcroft, Gordon Bell)
  - Rodney Brooks: « New formalisms will let us analyze complex distributed systems, producing new theroretical insights that lead to practical real-world payoffs. Exactly what the basis for these formalisms will be is, of course impossible to guess. My own bet is on resilience and adaptability »
- Feature section of IEEE Computer of March 2008, devoted to software engineering in the 21 st century
  - Barry Boehm: « Along with improving agility, future projects will need to improve the dependability of the software they produce, as software is becoming the dominant source of competitive differentiation in organizations' products and service. Simultaneously achieving and improving agility and dependability will be one of the biggest challenges for 21st-century software engineers »

- Society problem: filliing up the gap in dependability
- Other colleagues put high expectations on our abilities for future computing

- How can we transform addressing a society problem, needing to address failures from all sources, into a dream for government bodies, funding agencies, potential doctorate students?

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Collective marketing (lobbying?) issue:

From failures to dreams