Keynote

Business-Driven IT Management (BDIM) 2007

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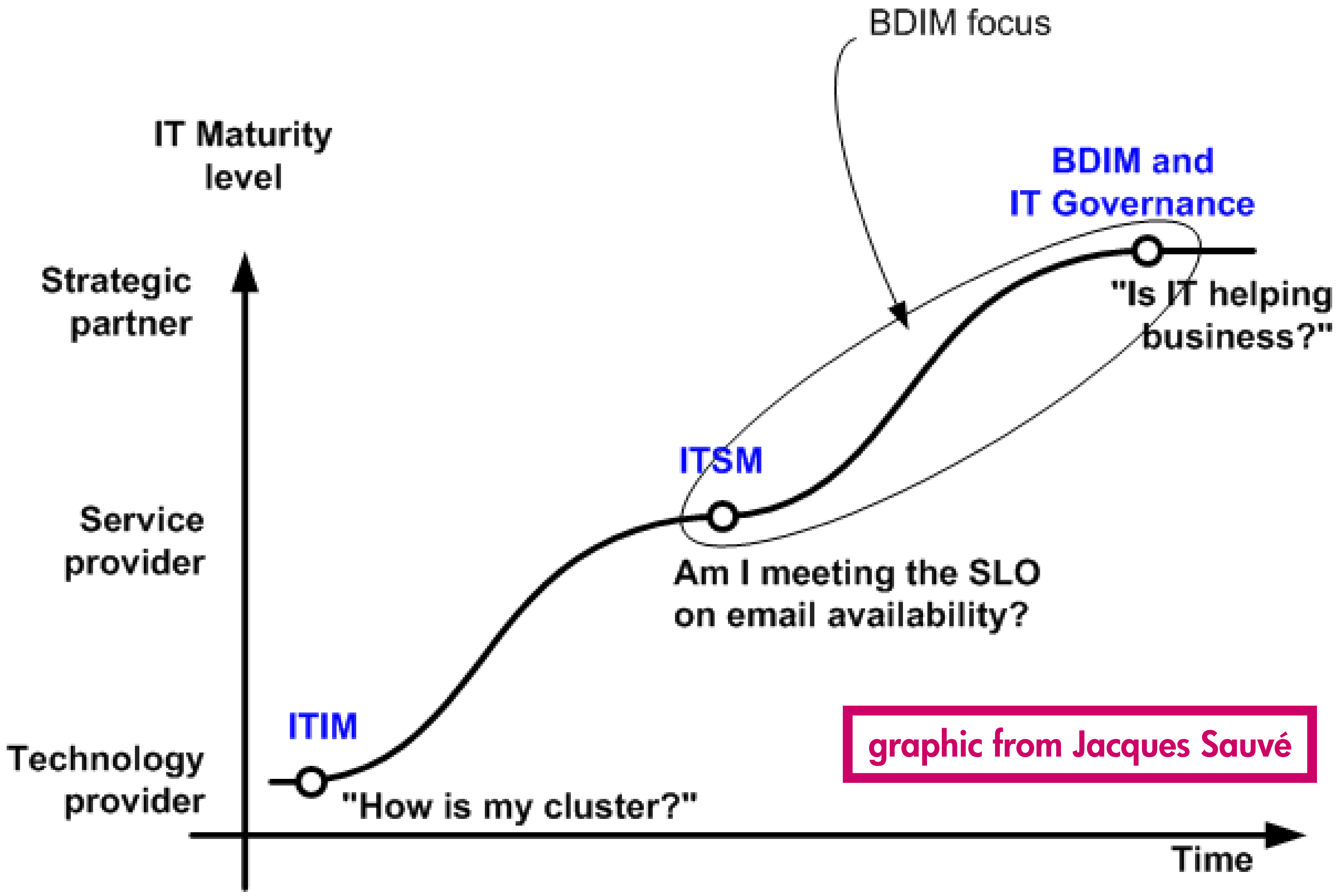
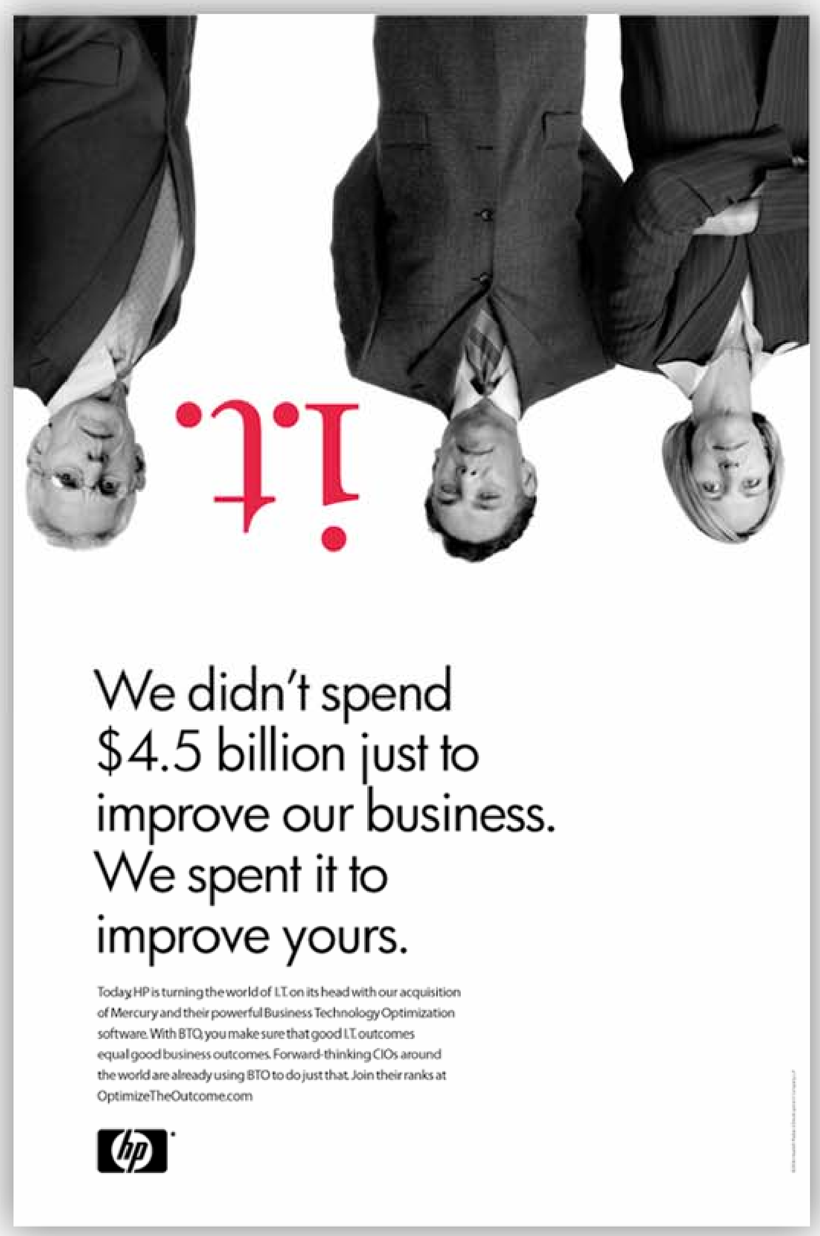
HP Labs, Palo Alto, California

Business-Driven IT Management



graphic from Jacques Sauvé



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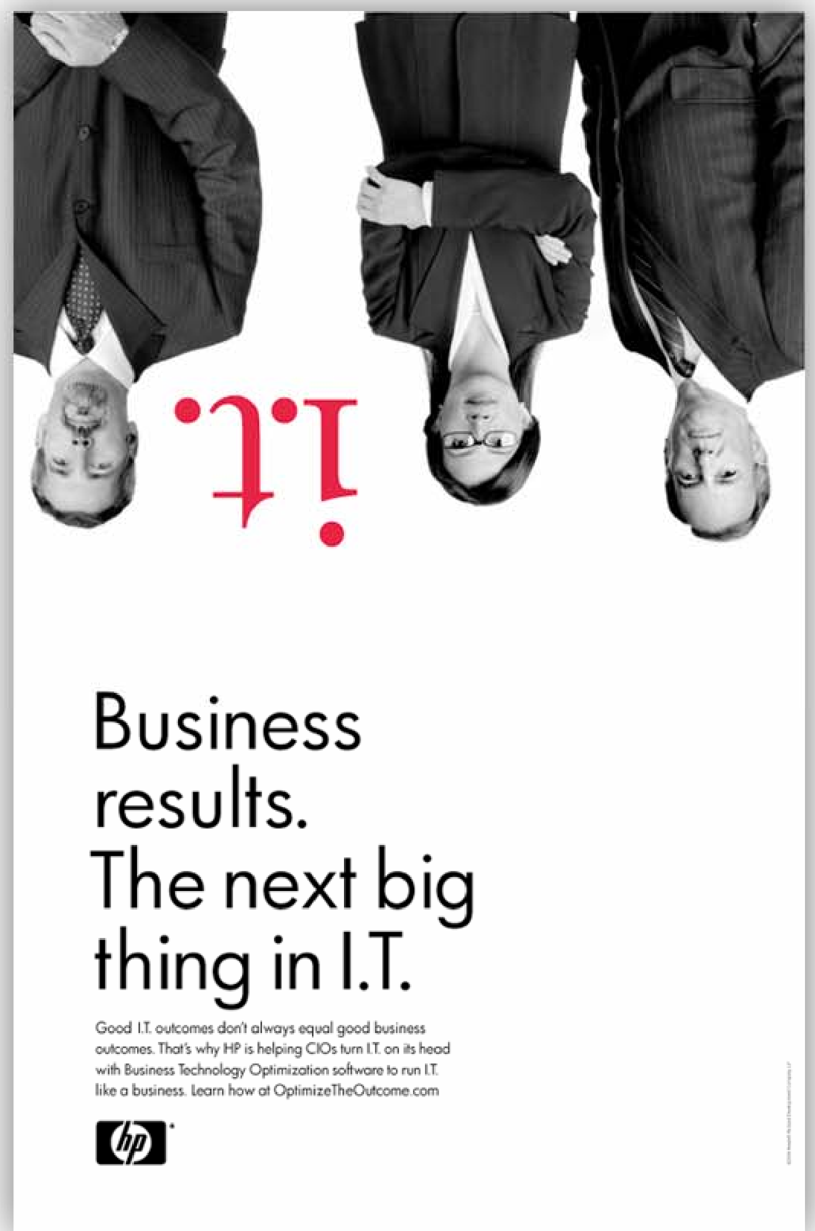

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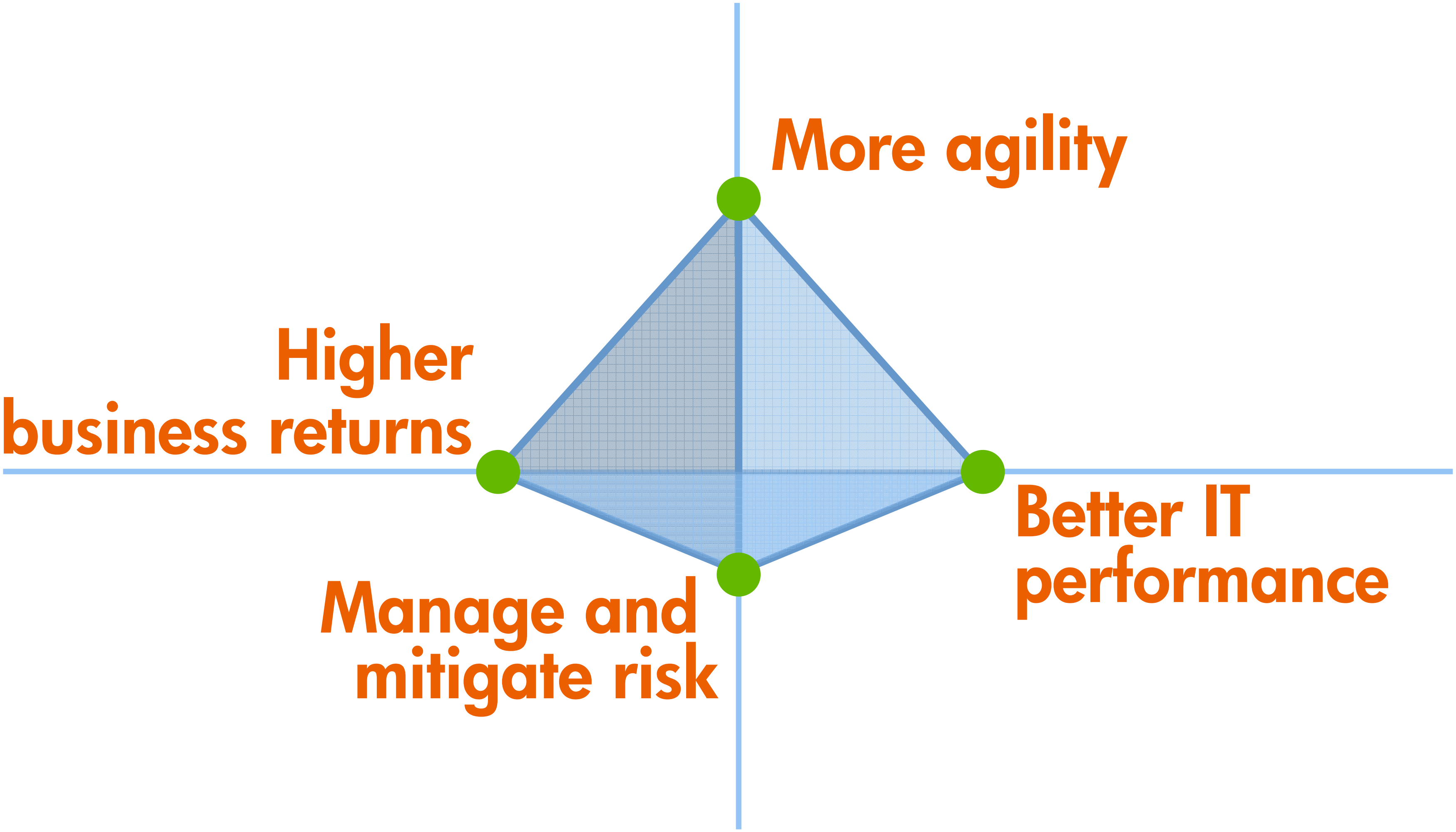
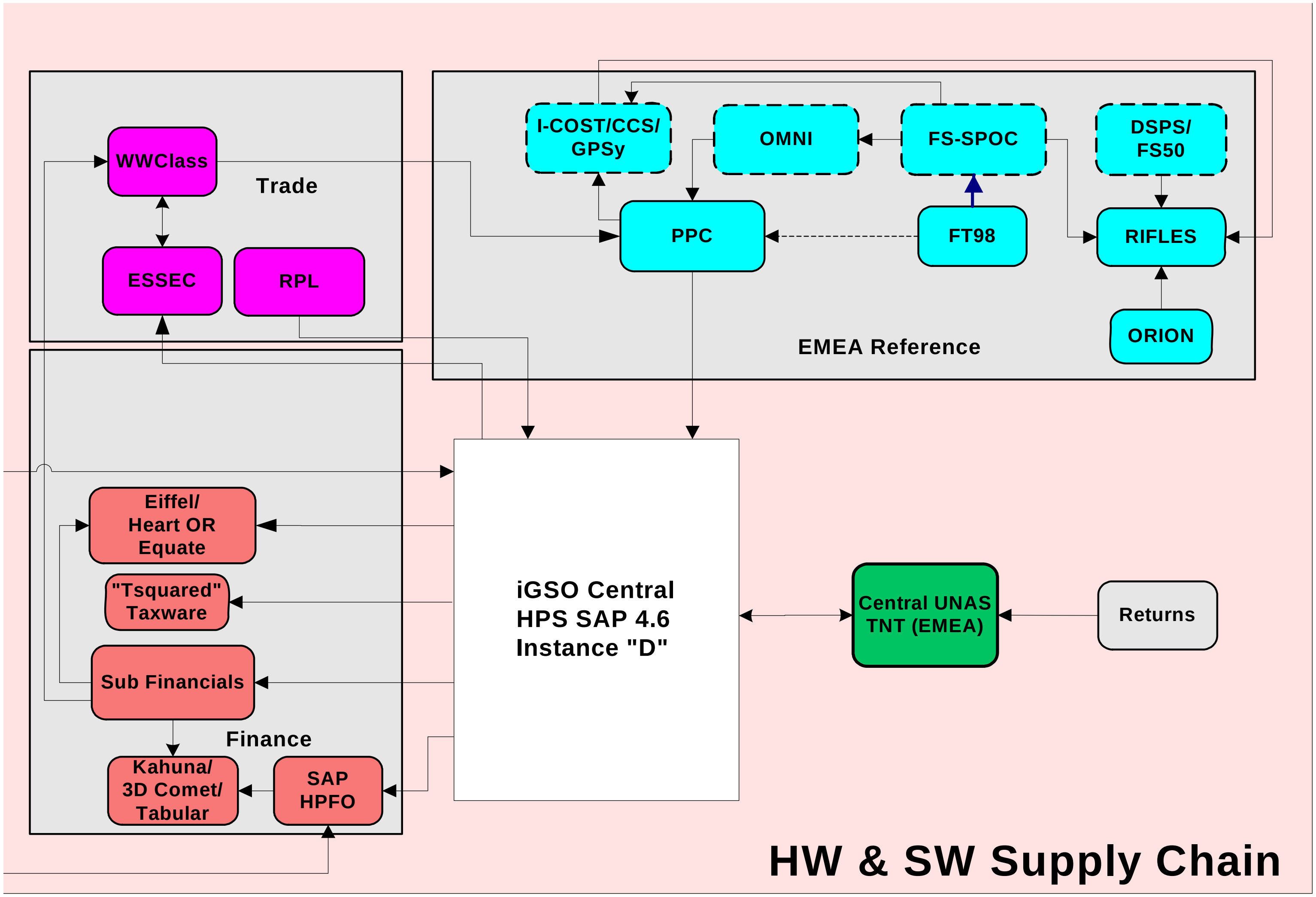
THE WALL STREET JOURNAL.

Q: what do CEOs/CIOs need?
A: run IT like a business

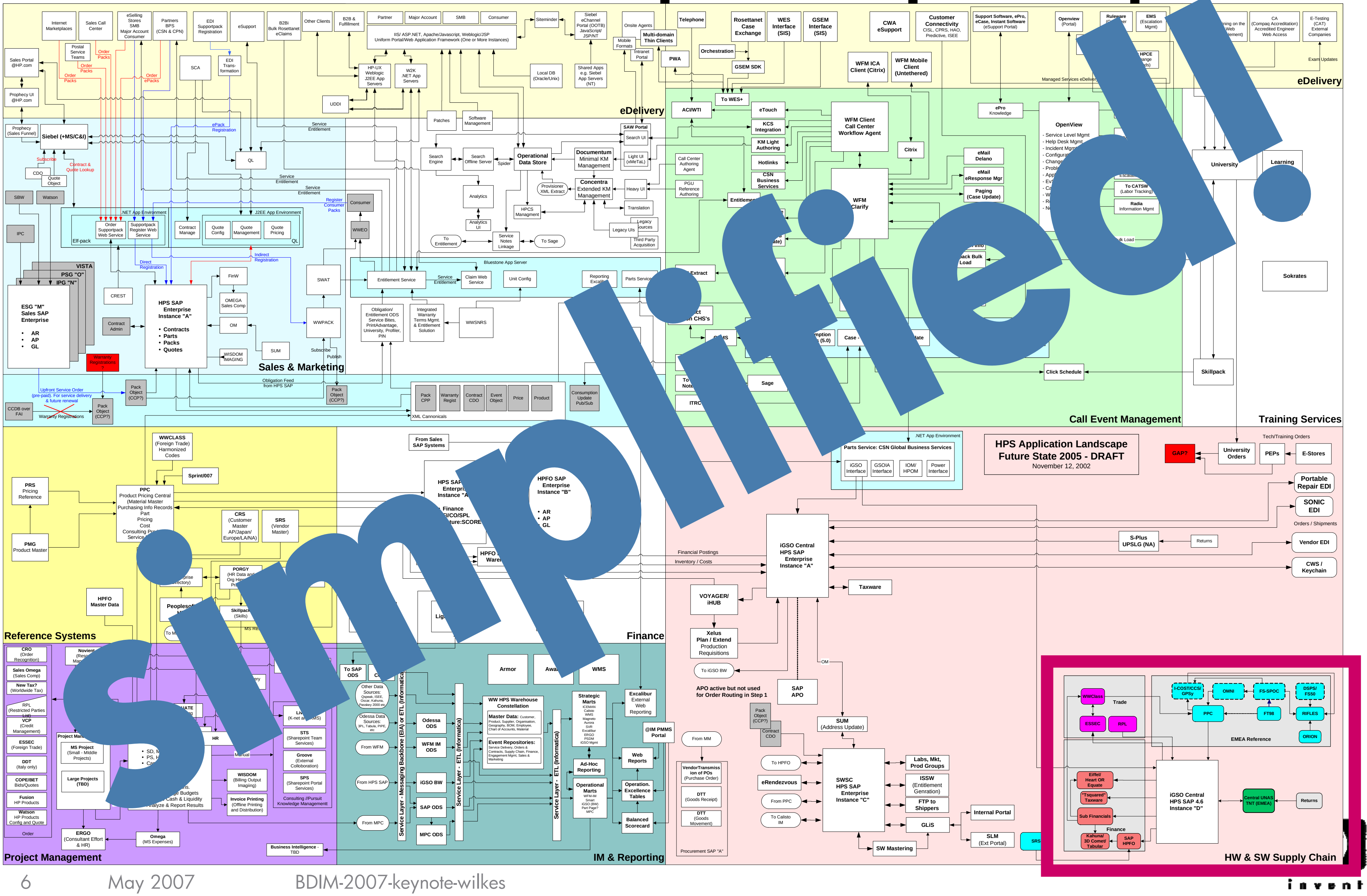


Running IT like a business
What's so hard? **Sample enterprise IT plan**



Running IT like a business

What's so hard? **Sample enterprise IT plan**

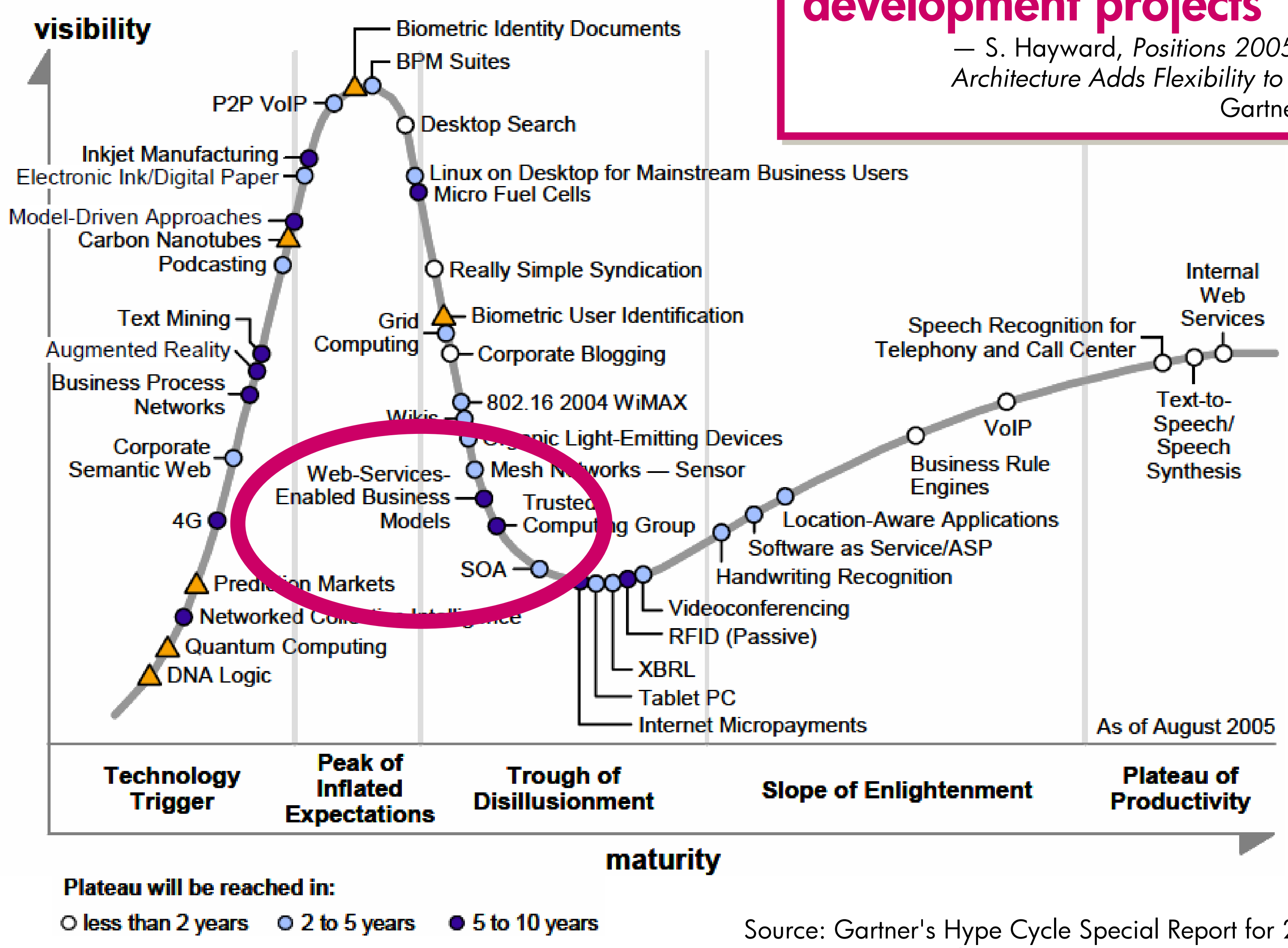


Running IT like a business
SOA is becoming real

By 2008, "SOA will provide the basis for 80 percent of new development projects"

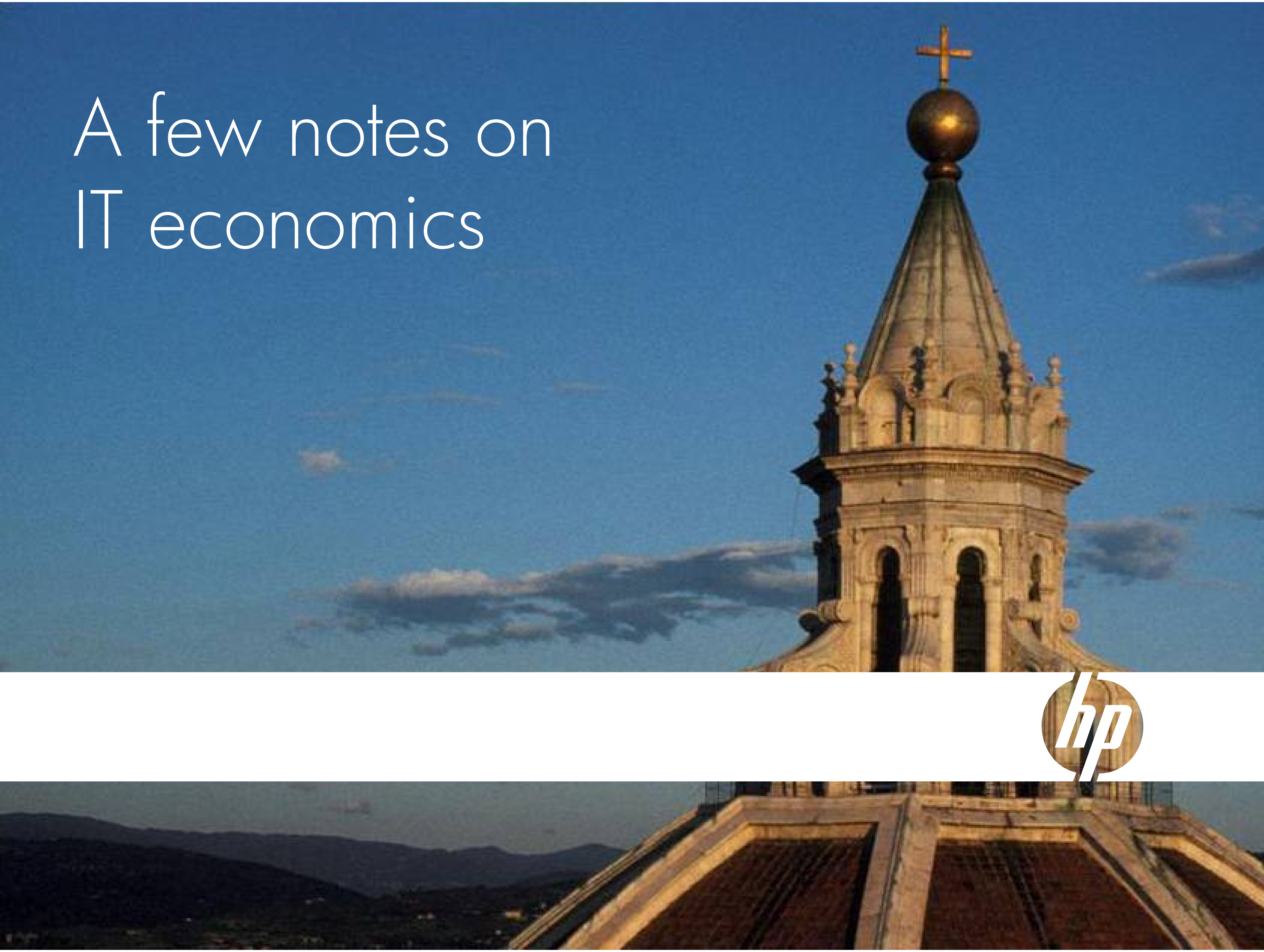
— S. Hayward, *Positions 2005: Service-Oriented Architecture Adds Flexibility to Business Processes*
Gartner, Inc. Feb. 2005.

Figure 2. Hype Cycle for Emerging Technologies, 2005



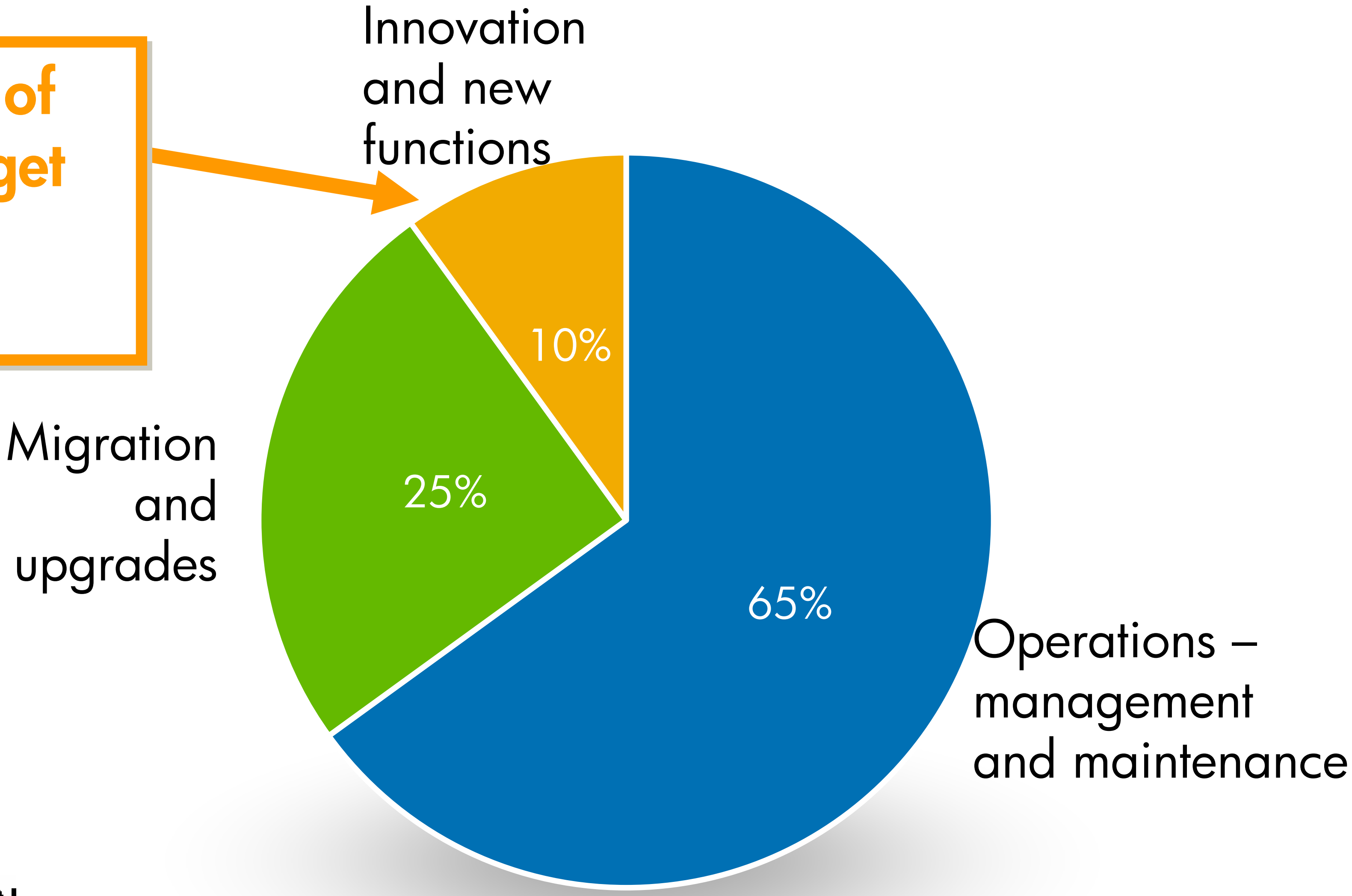
Source: Gartner's Hype Cycle Special Report for 2005, Aug 2005, ID Number: G00130115

A few notes on IT economics



IT spending: where does all the money go?

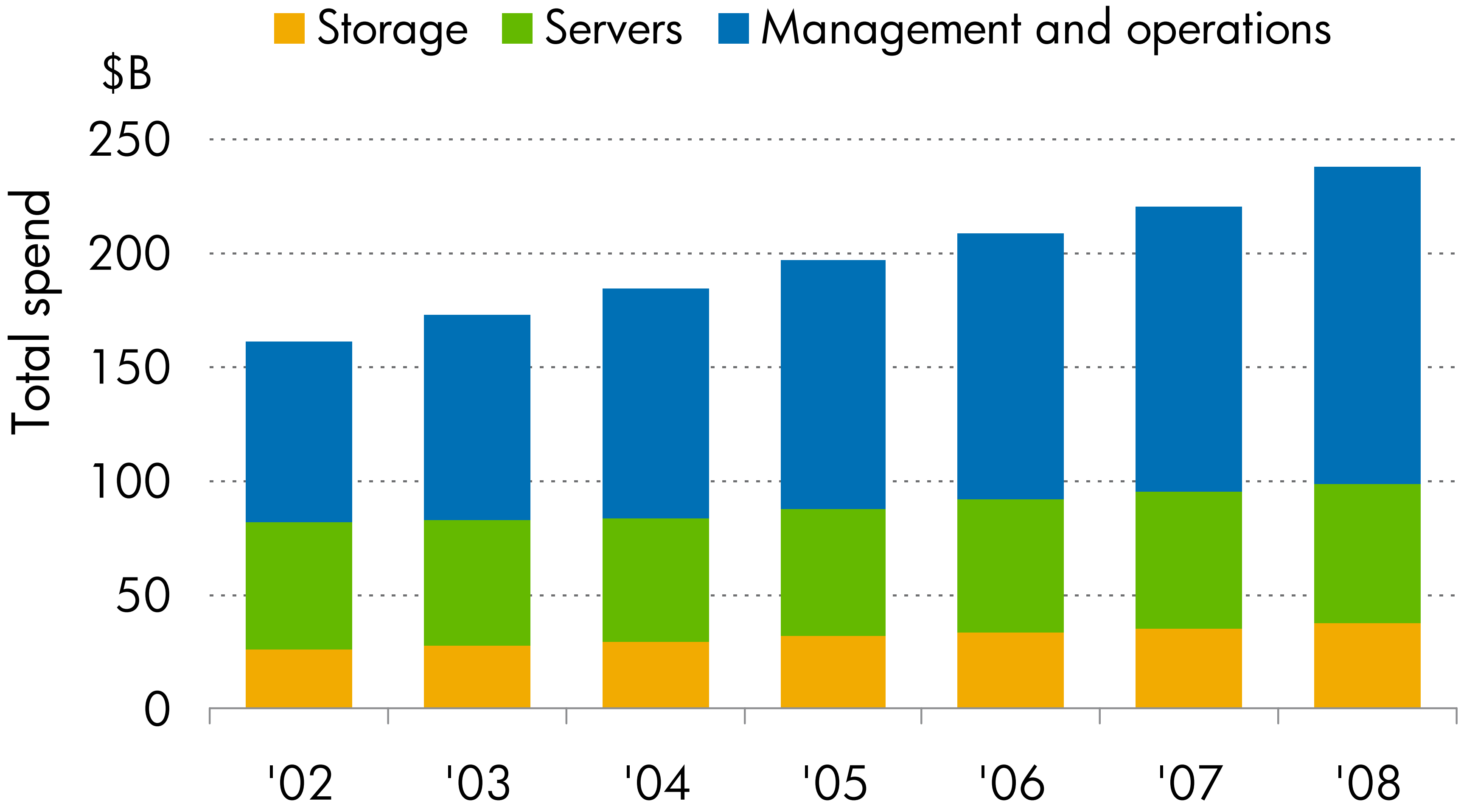
Only 10% of the IT budget is left for innovation



IDC Analyze the Future

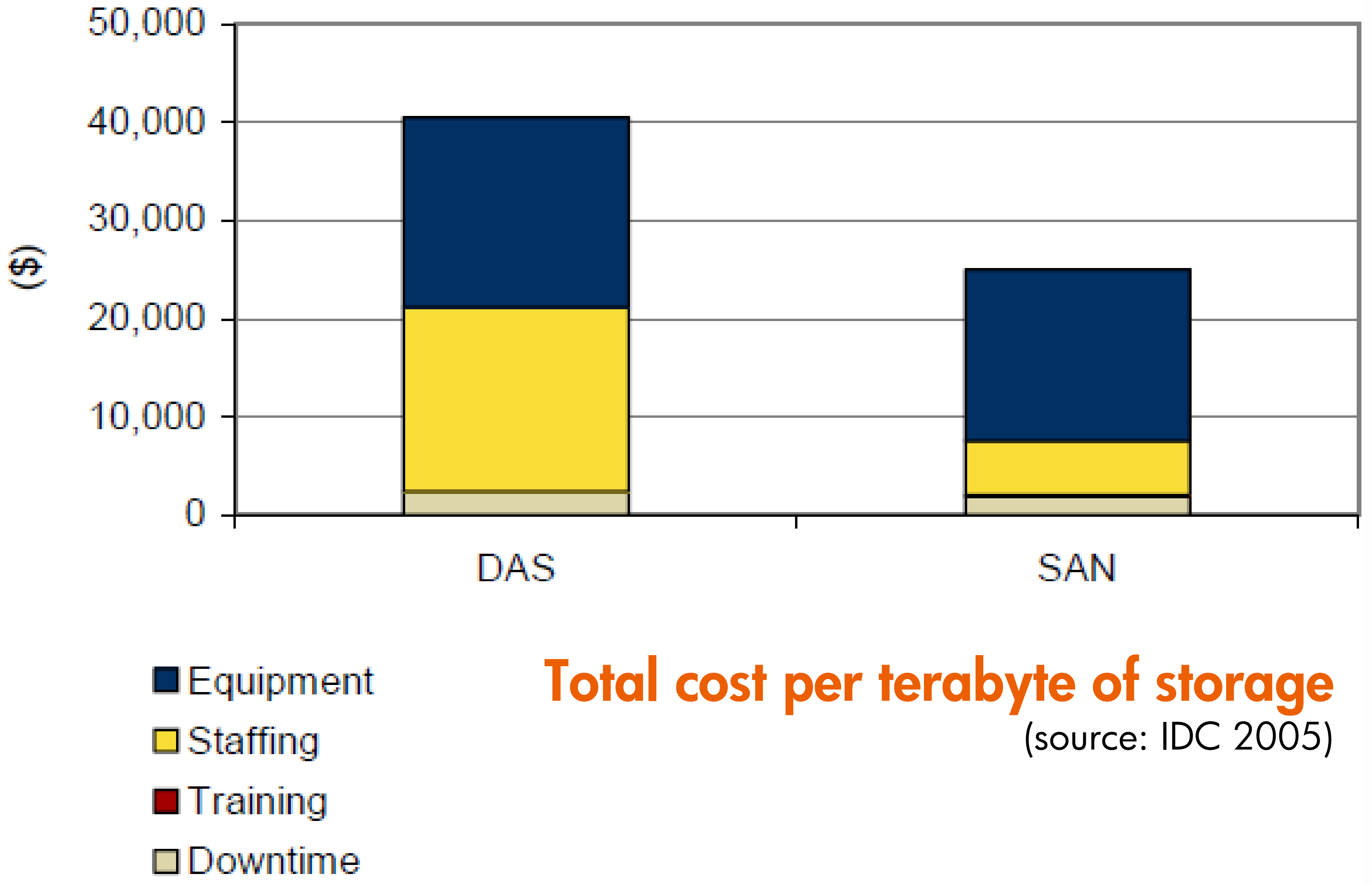
ALINEAN

IT spending: OPEX growing 3x faster than compute capacity spend



Sources: IDC, "On-Demand Enterprises and Utility Computing: A Current Market Assessment and Outlook," July 2004; HP analysis.
Storage spend includes storage management SW.

IT spending:
hardware vs administrator costs



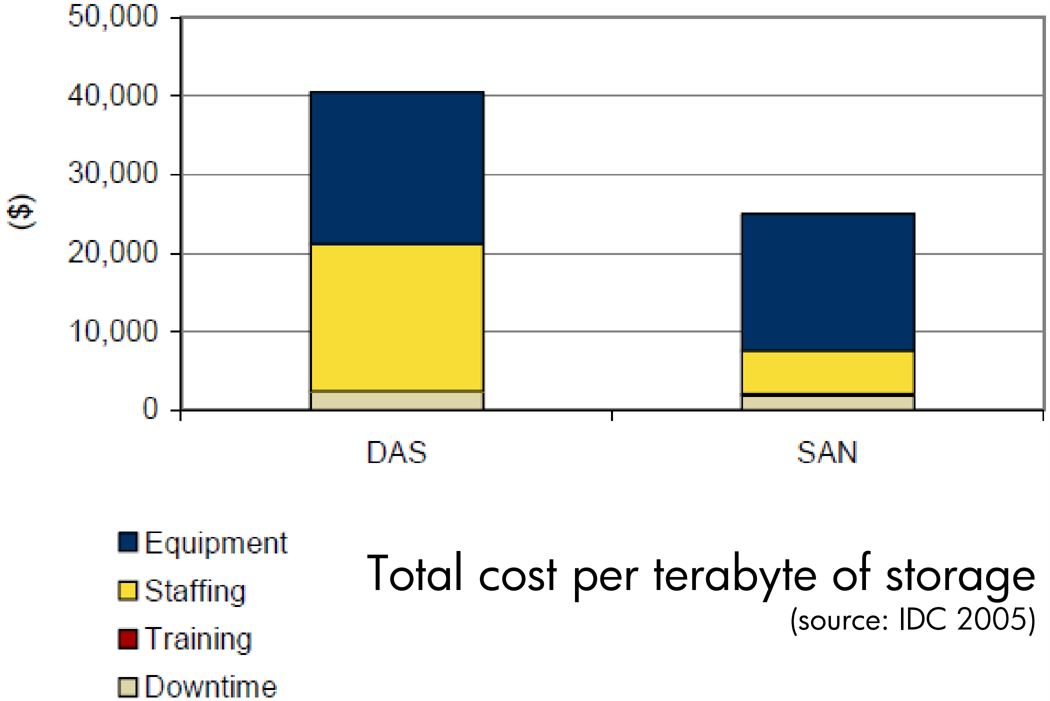
Total cost per terabyte of storage

(source: IDC 2005)

IT spending:
hardware vs administrator costs

- Storage costs are dropping
  - 1995: ~$5000/GB raw
  - 2005: $0.5/GB raw

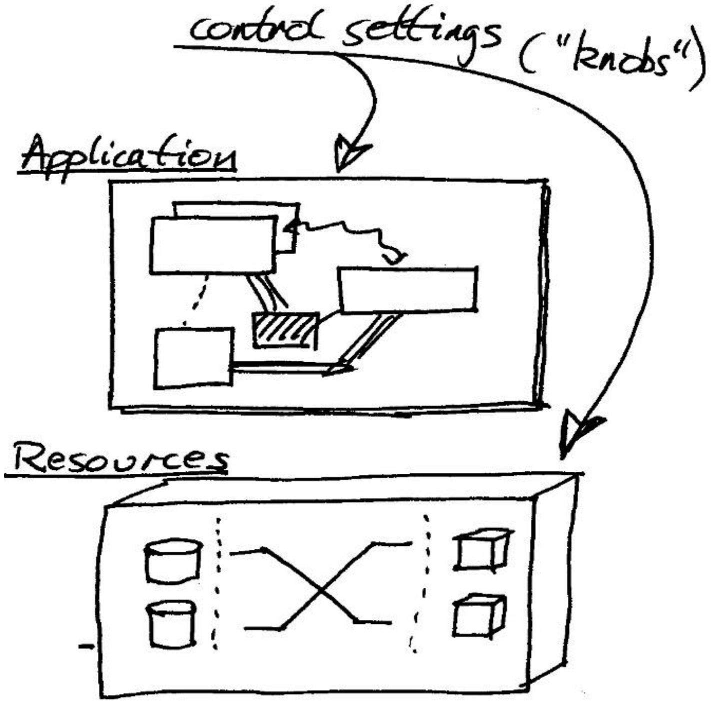
- People costs are not:
  - 2004–5 admin salary: US$68k
  - growing ~0–6%/year [SAGE-USA survey]



Total cost per terabyte of storage
(source: IDC 2005)

Solution: automation

Automation: control loops

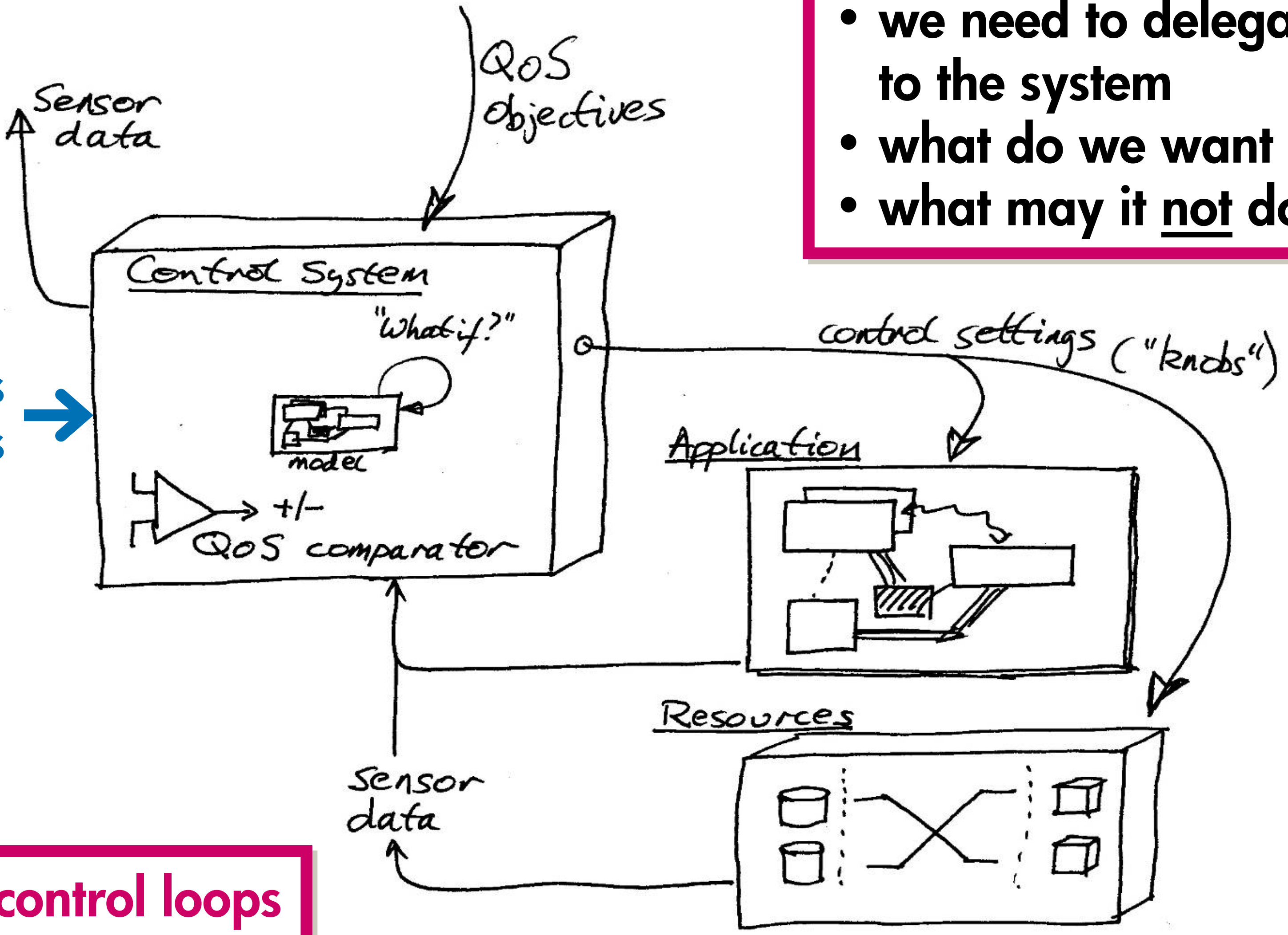


Automation: control loops

For this to work:

- **we need to delegate authority to the system**
- **what do we want it <u>to</u> do?**
- **what may it <u>not</u> do?**

business objectives →

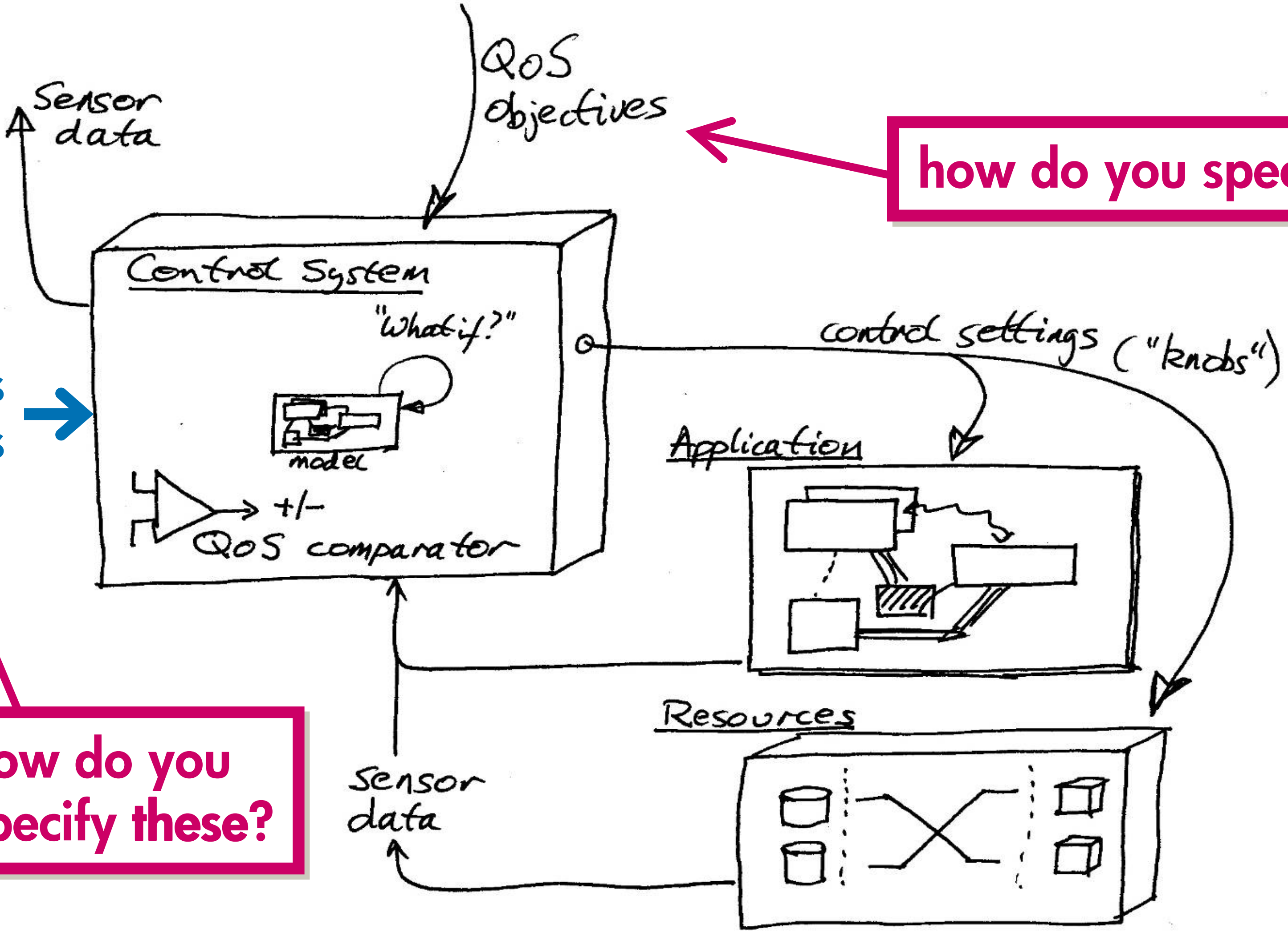


expect control loops to be nested!

BELLE-VUE

INTERBREW
20L

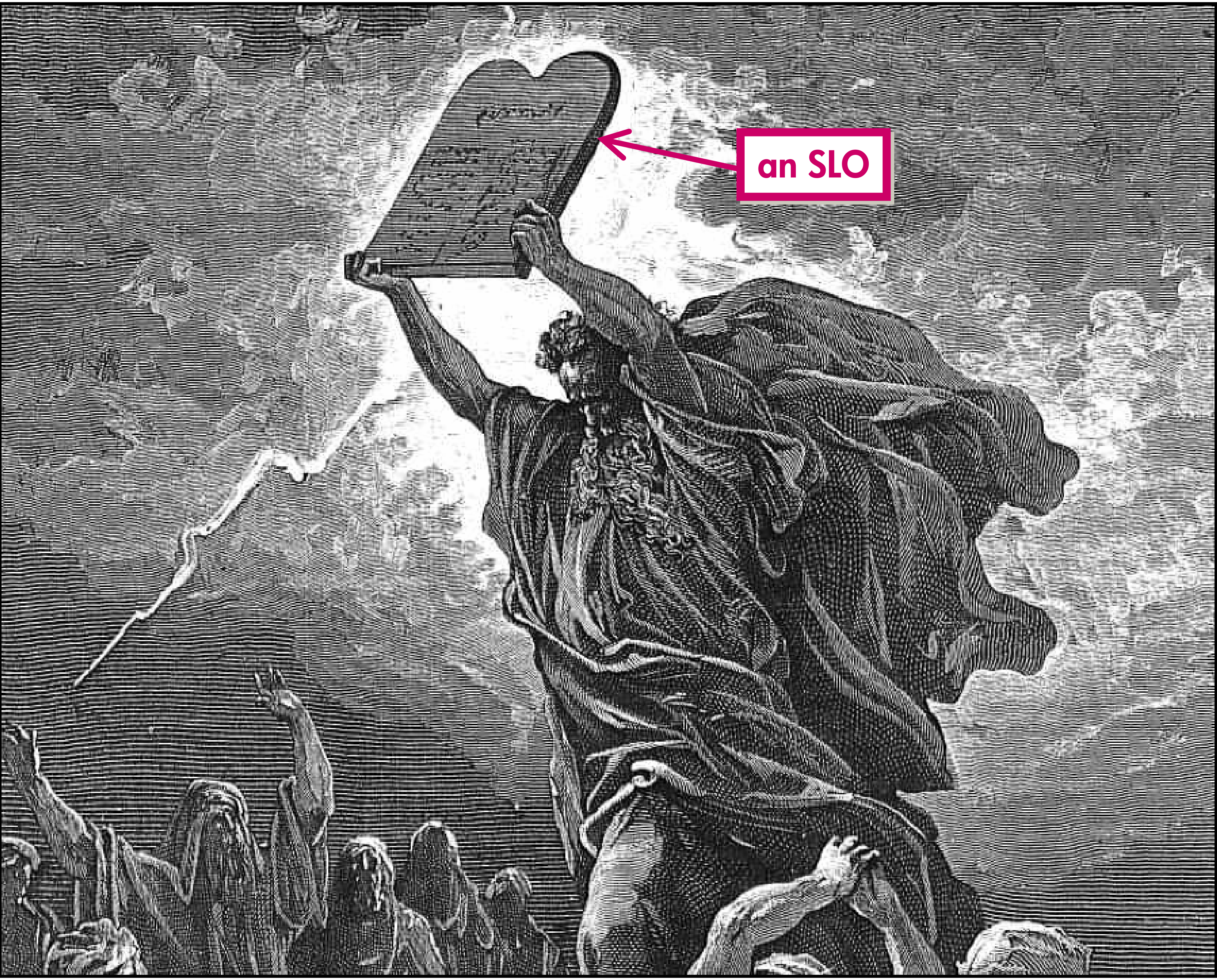
Automation: control loops



how do you specify these?

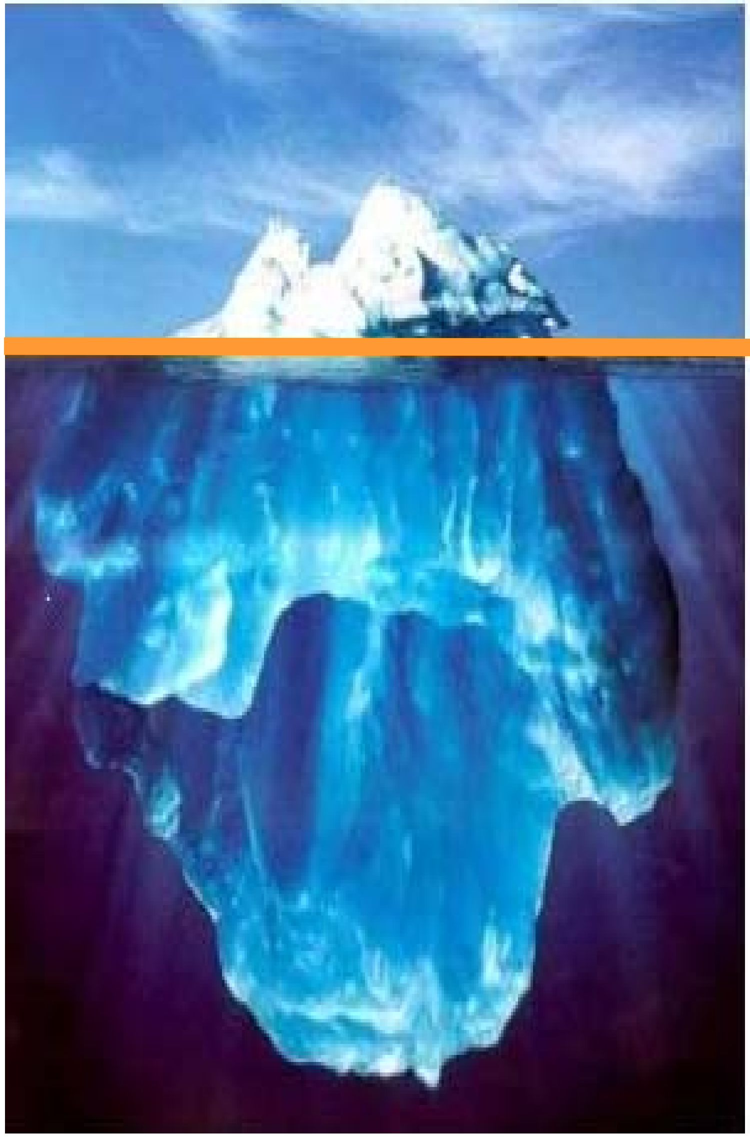
business objectives

how do you specify these?



an SLO

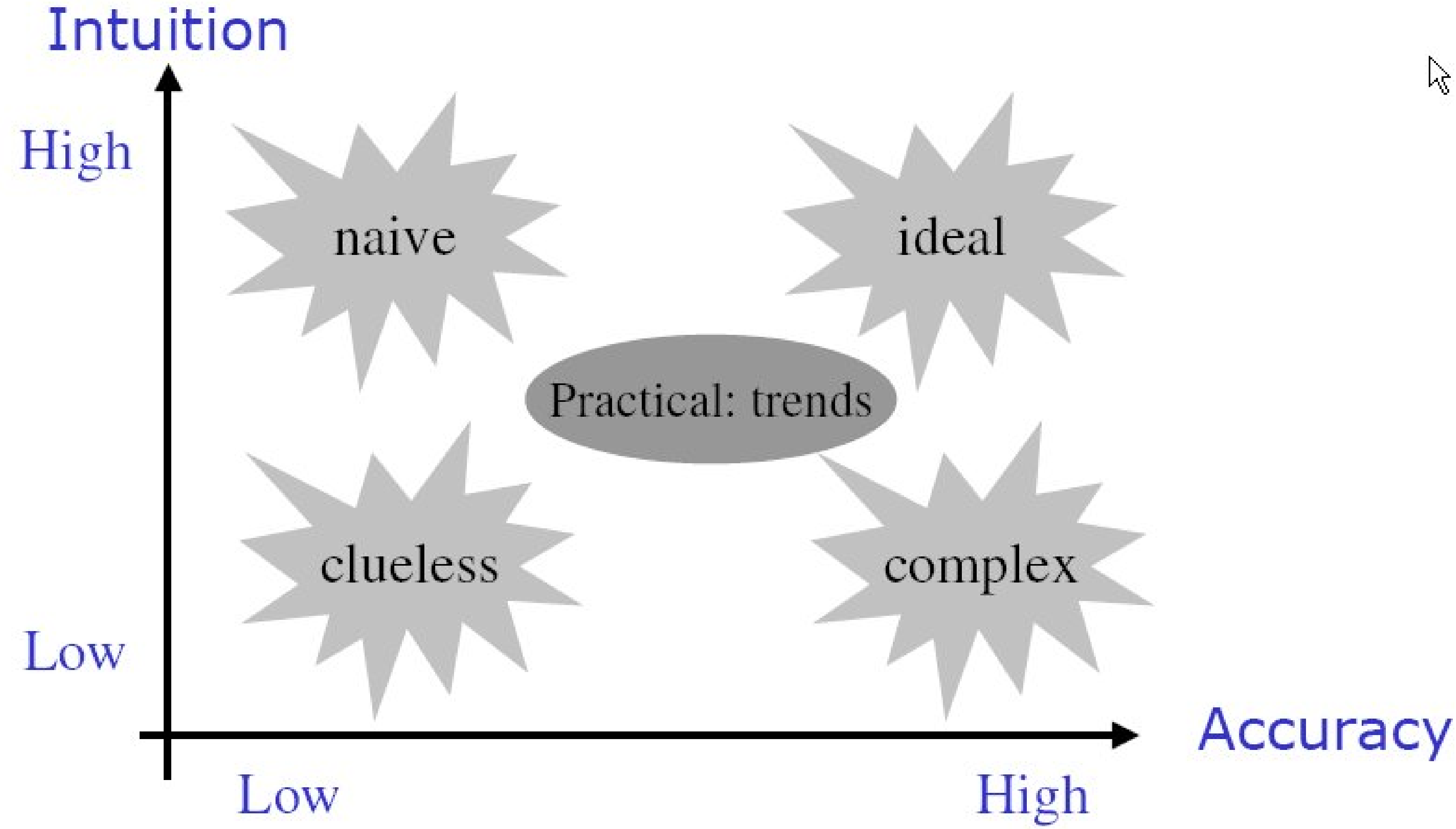
SLOs are not enough



service level objectives

everything else
needed in an SLA

We need simple SLAs … but effective ones



Suggested by Faloutsos, Dimacs Workshop 2002

Communicating business intent to IT

- We've had a hard time educating businesses about IT metrics
  - let's try doing the reverse ➔ BDIM
- What do business care about?
  - money
- What makes automation easier?
  - a single metric to optimize against

SLA structure

WS Agreement basics

- Agreement Name and Context
  - contains a name, purpose, information about parties, duration of the agreement, etc.
- Service Terms
  - service name, reference and other service properties
  - what service is offered and how it is offered
- Guaranteed Terms
  - service scope, qualifying conditions, service level objectives (SLOs), penalties and rewards

SLA structure what if …

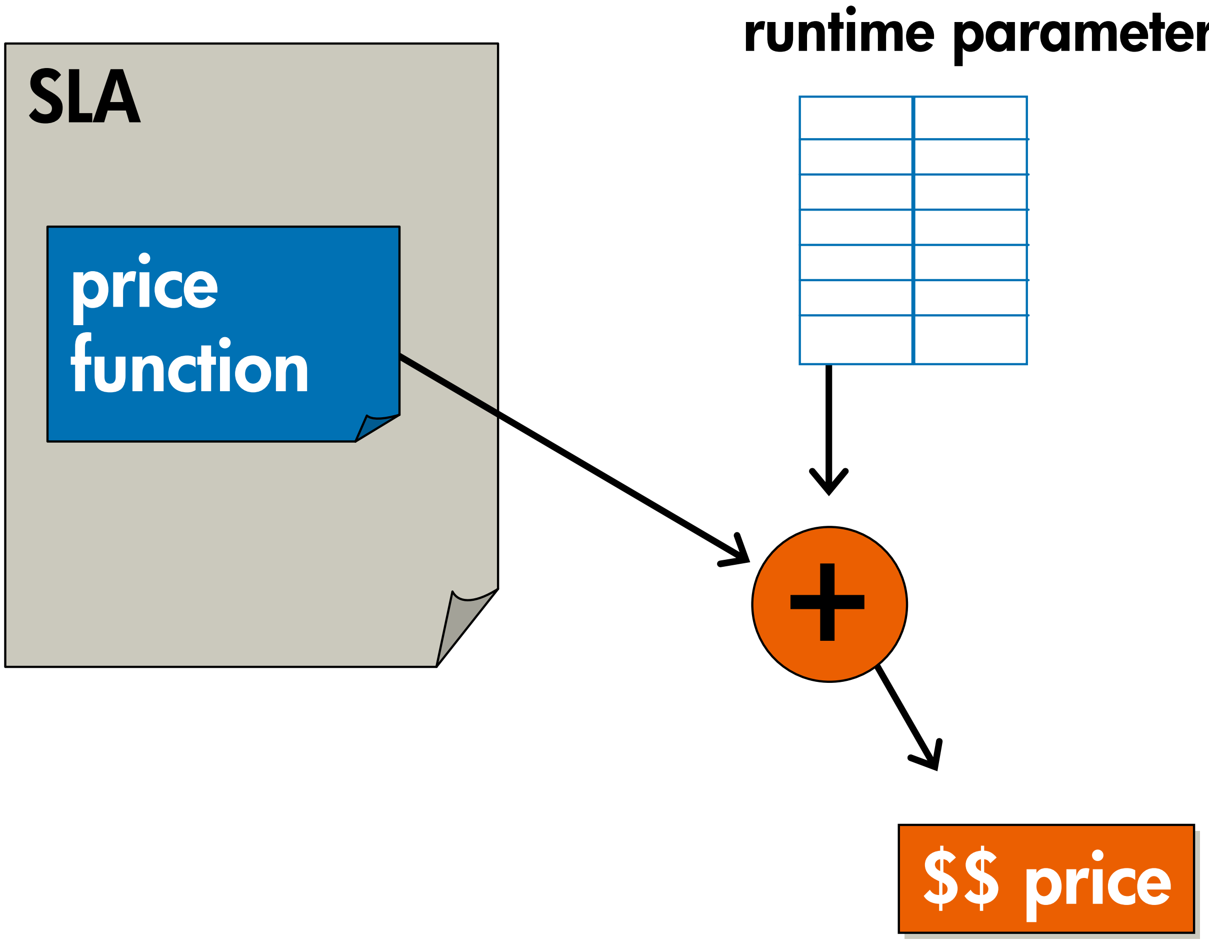
specify consequences, not behaviors!

- all the SLOs, service-level indicators, penalties, and rewards in an SLA

- were replaced by a single price function that specified how much the provider was paid
  - parameterized by service-level metrics
  - with payments for desired outcomes
  - penalties for bad ones
  - omitting all details of *how* the outcomes are achieved

SLA structure
price functions

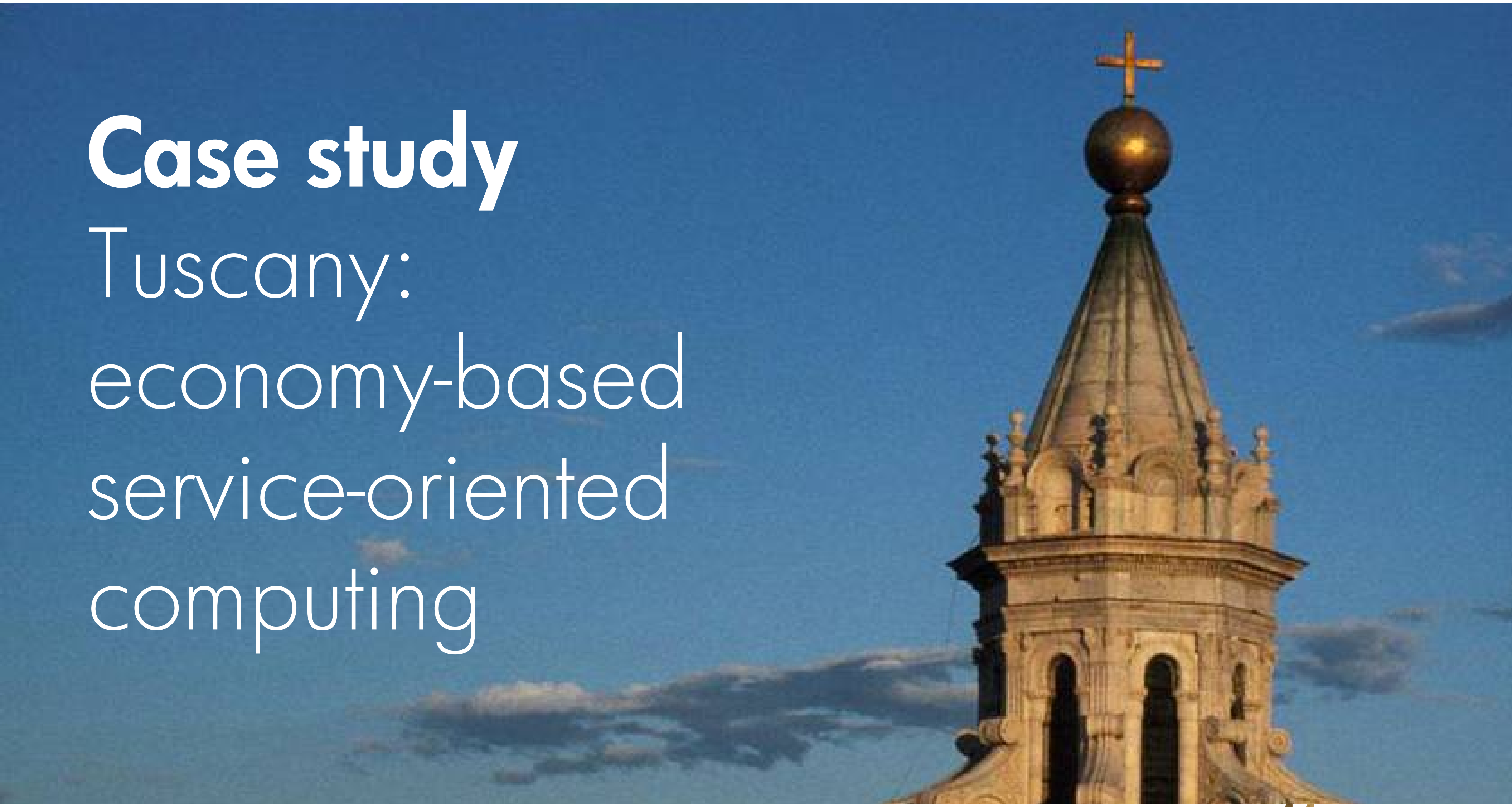
specify consequences, not behaviors!



SLA structure
price functions

specify consequences, not behaviors!

- one price function in each SLA
  - selected any way the service provider likes
- *function(set of metrics/parameters)* → a *price*
  - must be deterministic!
- evaluated by:
  - service provider to work out what to charge
  - client to predict what might happen
  - third party to audit



Case study

Tuscany: economy-based service-oriented computing

Tuscany – key ideas

Economy-based service-oriented computing

- Prices as reward/punishment in SLA

  ➔ clarify desired behavior

- Self-interested service providers

  ➔ seeking to maximize profitability

- Automated self-management

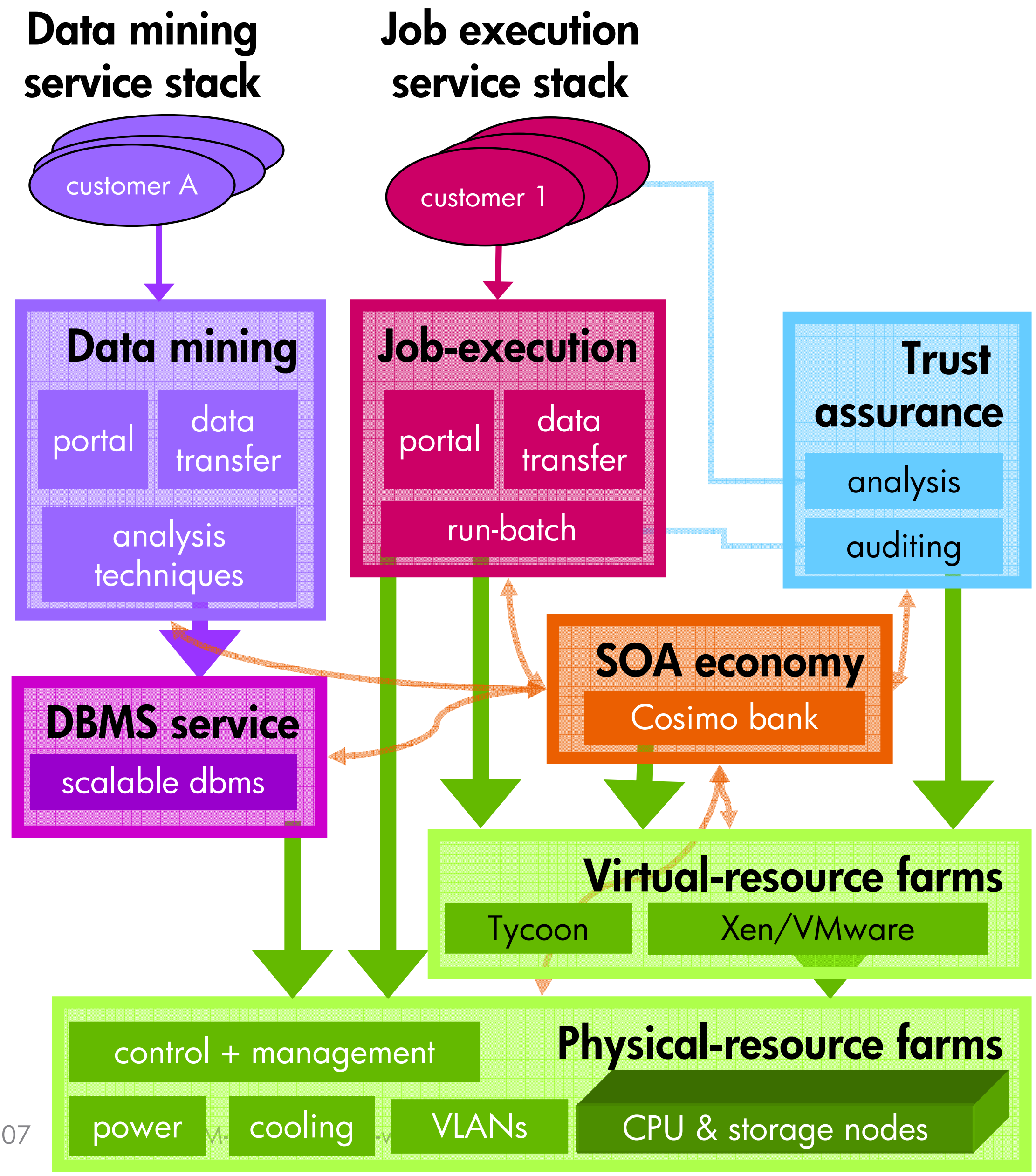
  ➔ cost-effective, lights-out, agile operation

Tuscany – key ideas

Economy-based service-oriented computing

- easier automation
  - smaller optimization context, single metric to optimize
- easier to understand where to invest
  - look for max ROI
- greater transparency ➔ better accountability
- encourages competition ➔ better services
- narrower interfaces
  - specify consequences, not behaviors

Tuscany ecosystem – a sample



Data mining service stack

customer A

Job execution service stack

customer 1

Data mining

portal

data transfer

analysis techniques

Job-execution

portal

data transfer

run-batch

Trust assurance

analysis

auditing

SOA economy

Cosimo bank

DBMS service

scalable dbms

Virtual-resource farms

Tycoon

Xen/VMware

Physical-resource farms

control + management

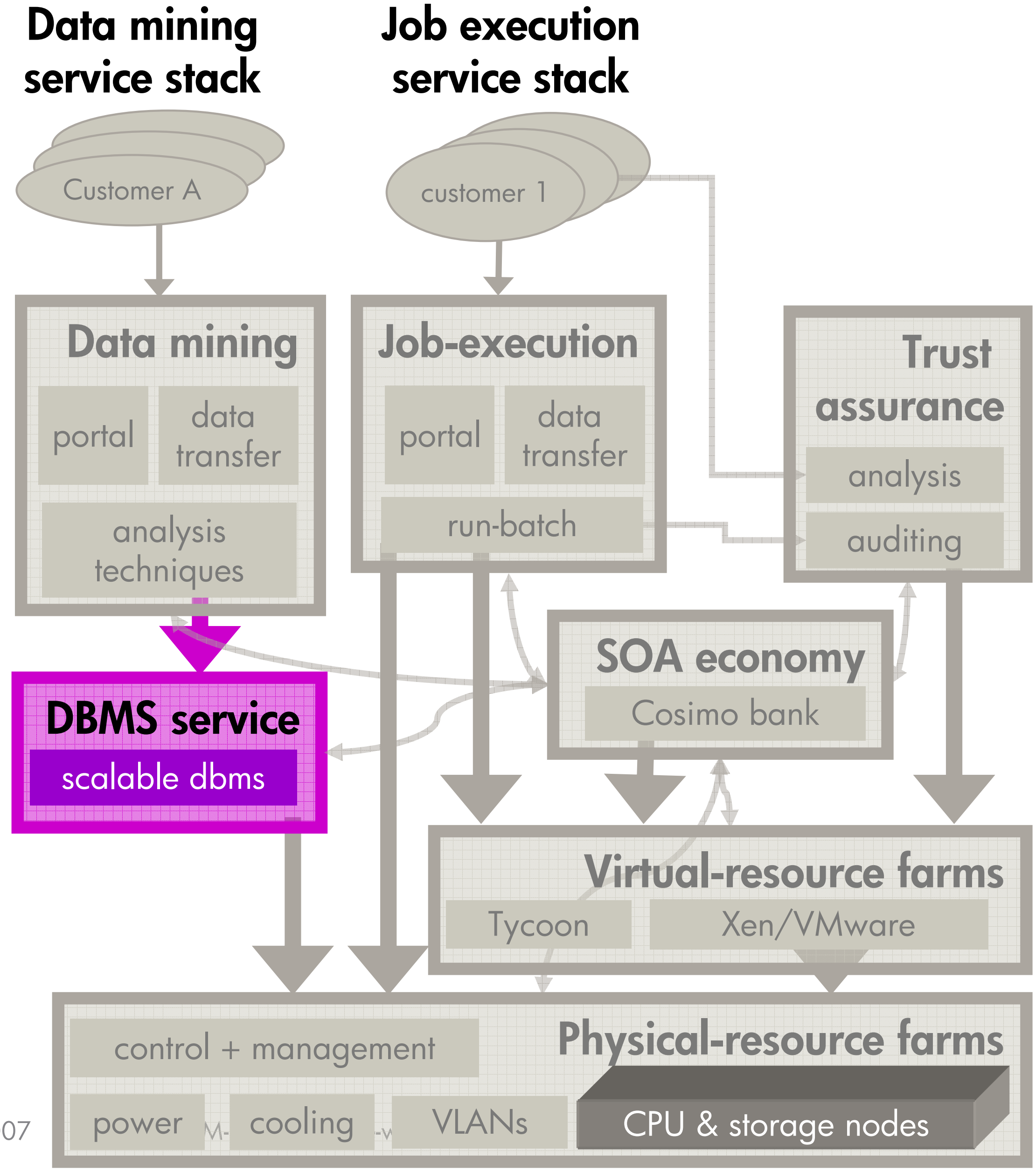
power

cooling

VLANs

CPU & storage nodes

Tuscany ecosystem
Prato: dbms-on-demand service



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CPU & storage nodes

Tuscany ecosystem
Prato: dbms-on-demand service

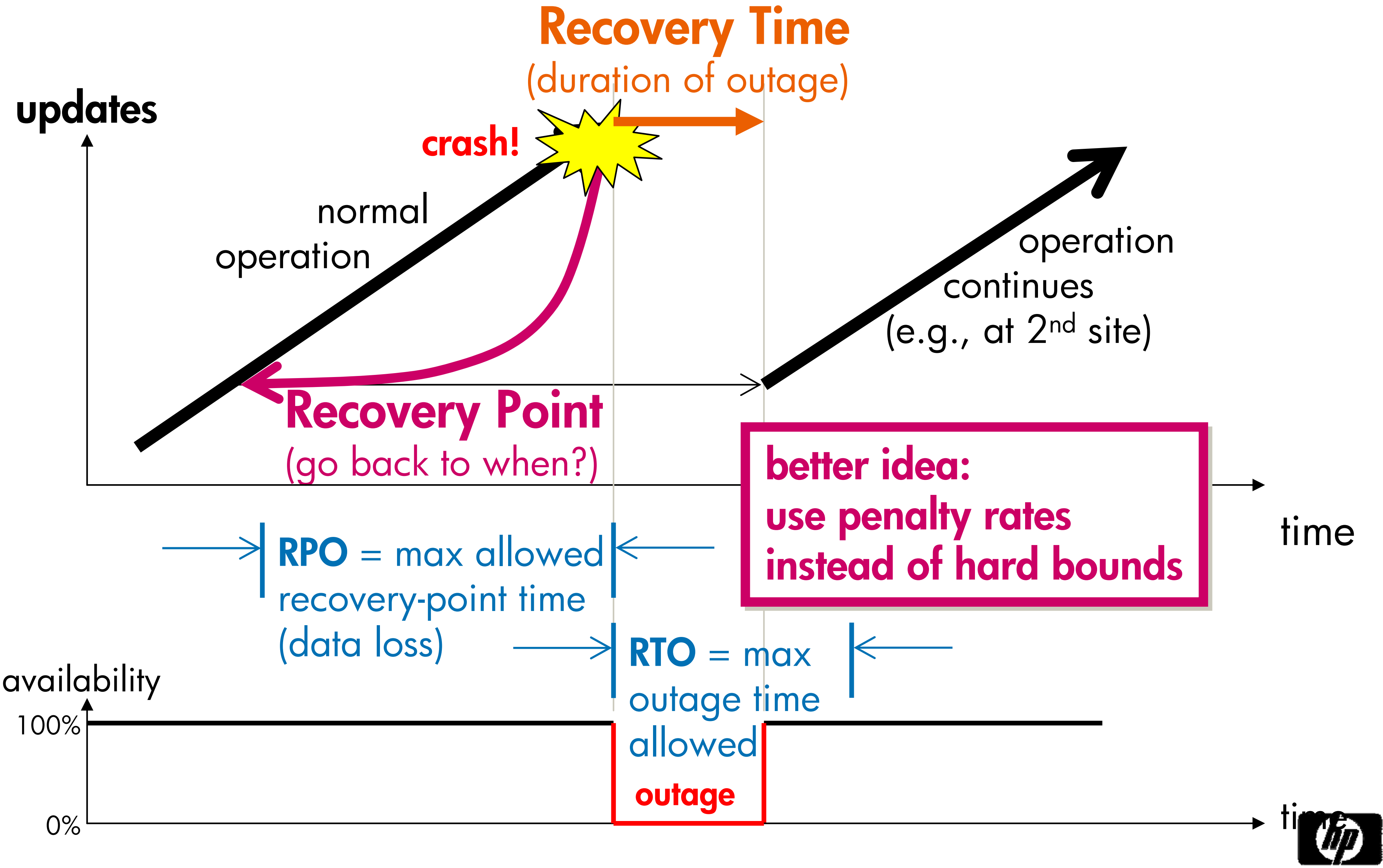
- a self-managing service provider

- that offers a dbms-on-demand service
  - 2x capacity for 3 days!
  - goes 10x faster!

- by giving each client their own virtual dbms appliance

- and hiding the complexity of:
  - setting up and managing the service

Designing data protection
Anatomy of a failure



Recovery Time
(duration of outage)

updates

crash!

normal operation

operation continues (e.g., at 2nd site)

Recovery Point
(go back to when?)

better idea:
use penalty rates
instead of hard bounds

time

RPO = max allowed recovery-point time (data loss)

RTO = max outage time allowed

availability

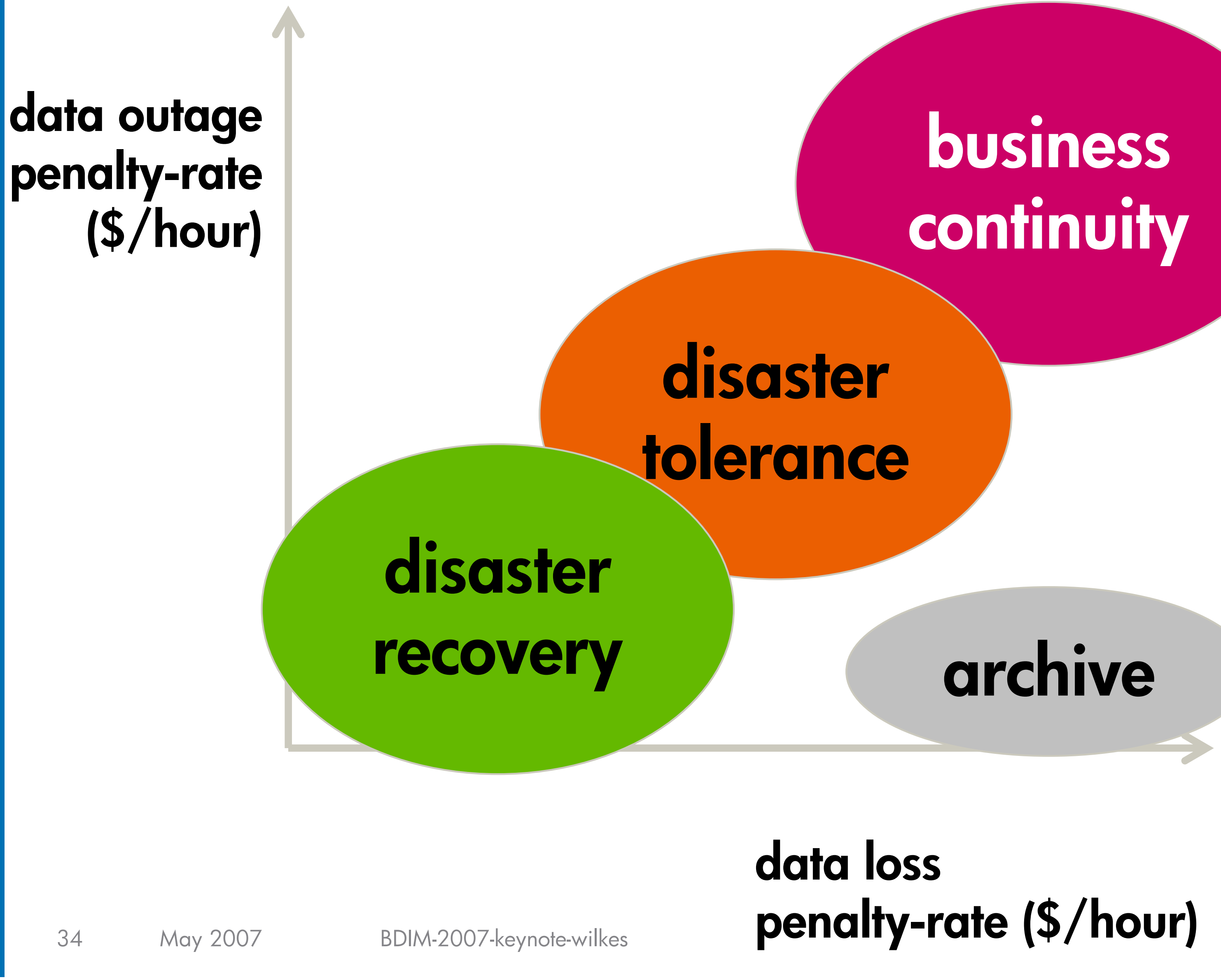
100%

0%

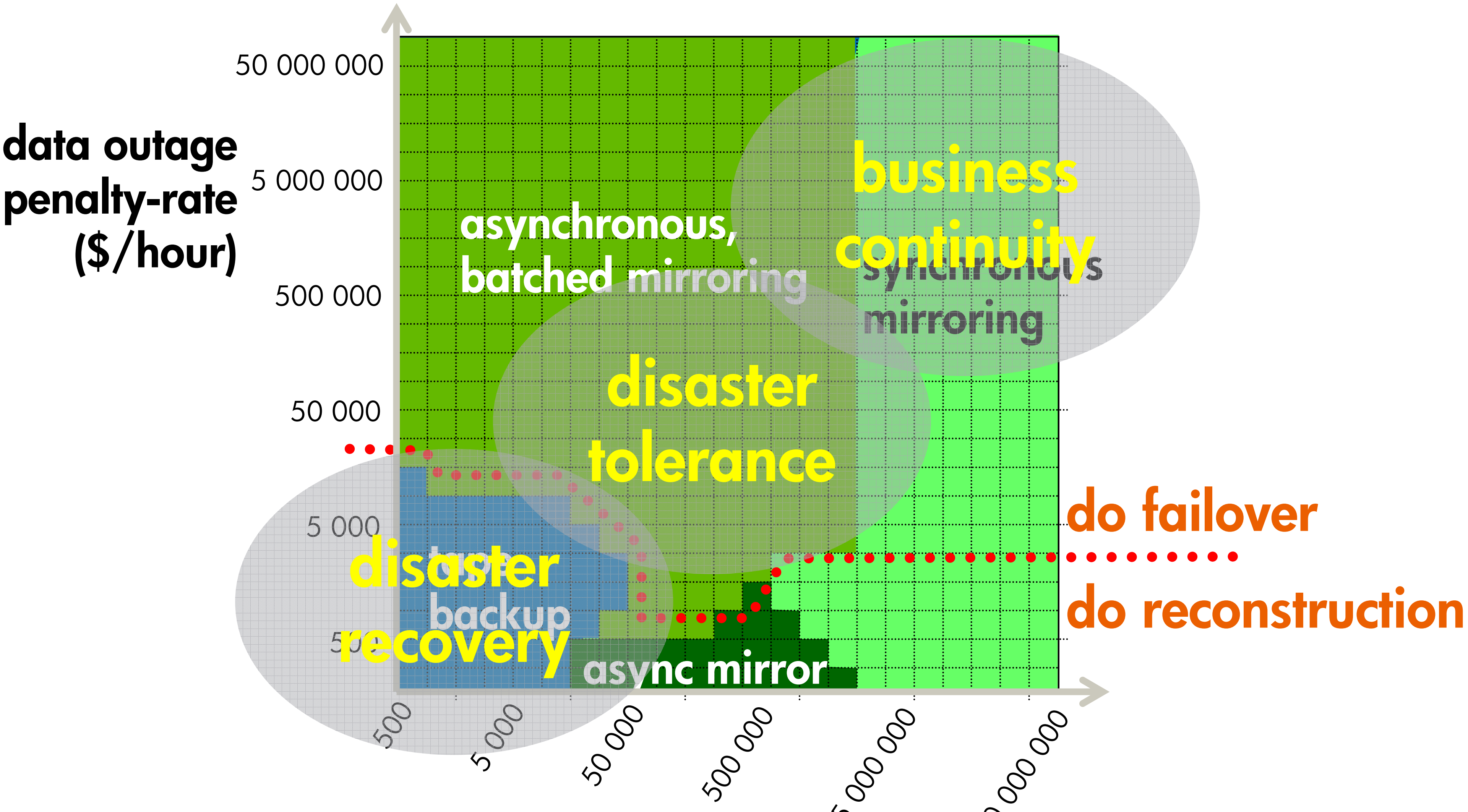
outage

time

Designing data protection
Specify SLA via penalties



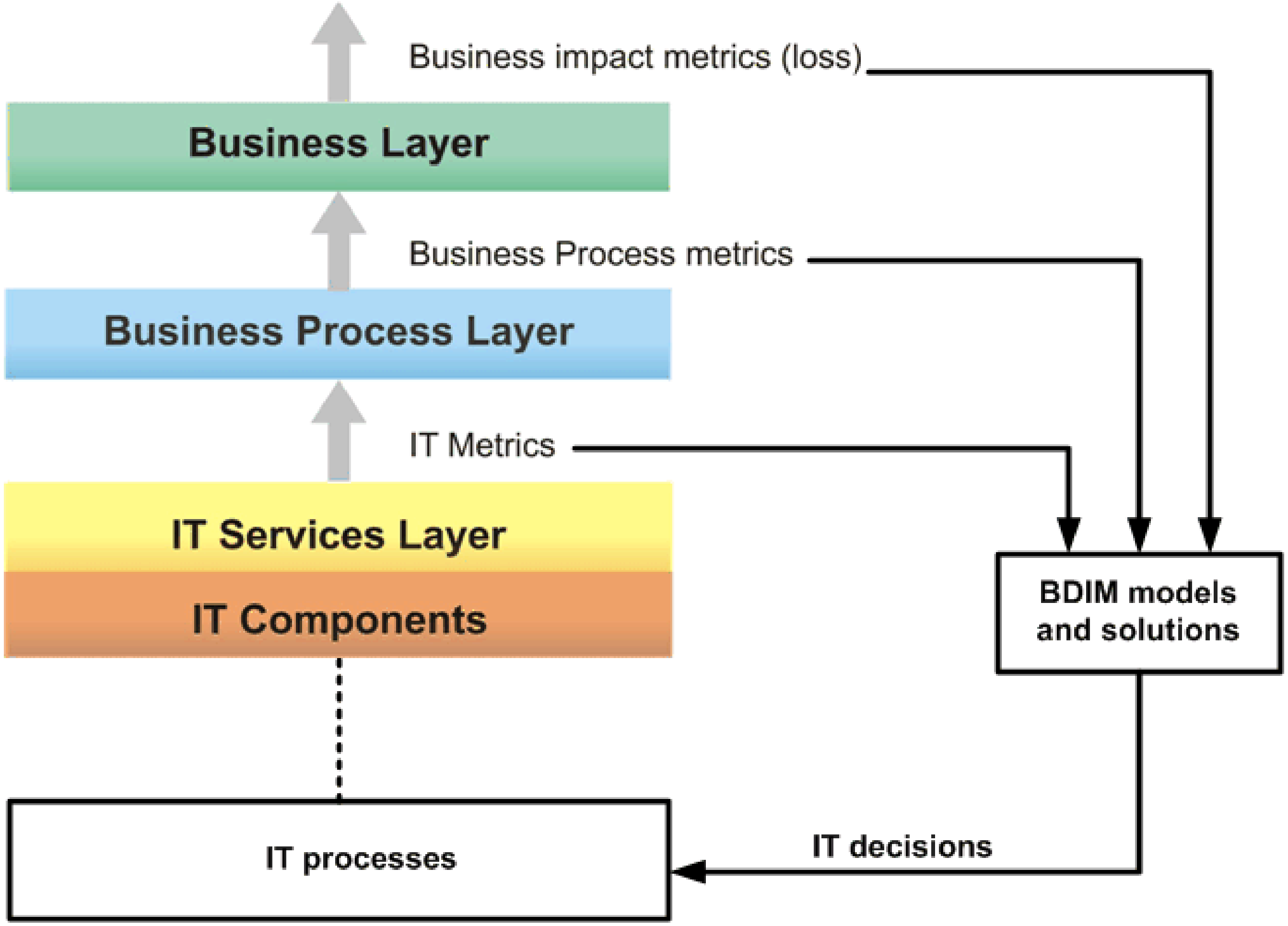
Designing data protection
Automation simplifies choosing



Designing for disasters K. Keeton et al., *File and Storage Technologies (FAST'04)*, Mar-Apr 2004.

Designing data protection
Automation simplifies choosing

- that example was from storage systems
  - but the ideas apply equally well to other IT systems



graphic from Jacques Sauvé

Prato research focus
automatic QoS spec ➔ service design

Client specifies:

- dbms size
  - RAM (GB), disk (GB)
  - "in-memory" ➔ high-performance
- **outage and data-loss penalty rates**
  - florins/hour
- data-isolation breach penalty
  - florins/occurrence
- contract start-date + duration
  - date, hours

Prato chooses:

- capacity + speed
  - number of nodes
  - amount of disk, amount of RAM
- **data-protection approach**
  - [lots of choices]
- security-isolation approach
  - air-gap; VLANs, VMs, DBMS
- **contract price**

Related challenges

Trust

Trust

- Requires belief in performance, resiliency, and security properties + the systems that provide them

- Technical solutions exist: these are not the hard part

Trust

- Opportunity: methods to build **trust**
  - will the proposed design work? ➔ design audit
  - has the design been deployed? ➔ deployment audit
  - has the design been altered? ➔ runtime audit
  - was it adequate? ➔ runtime audit

- If the client and service provider don't fully trust one another, use a mutually-trusted third party

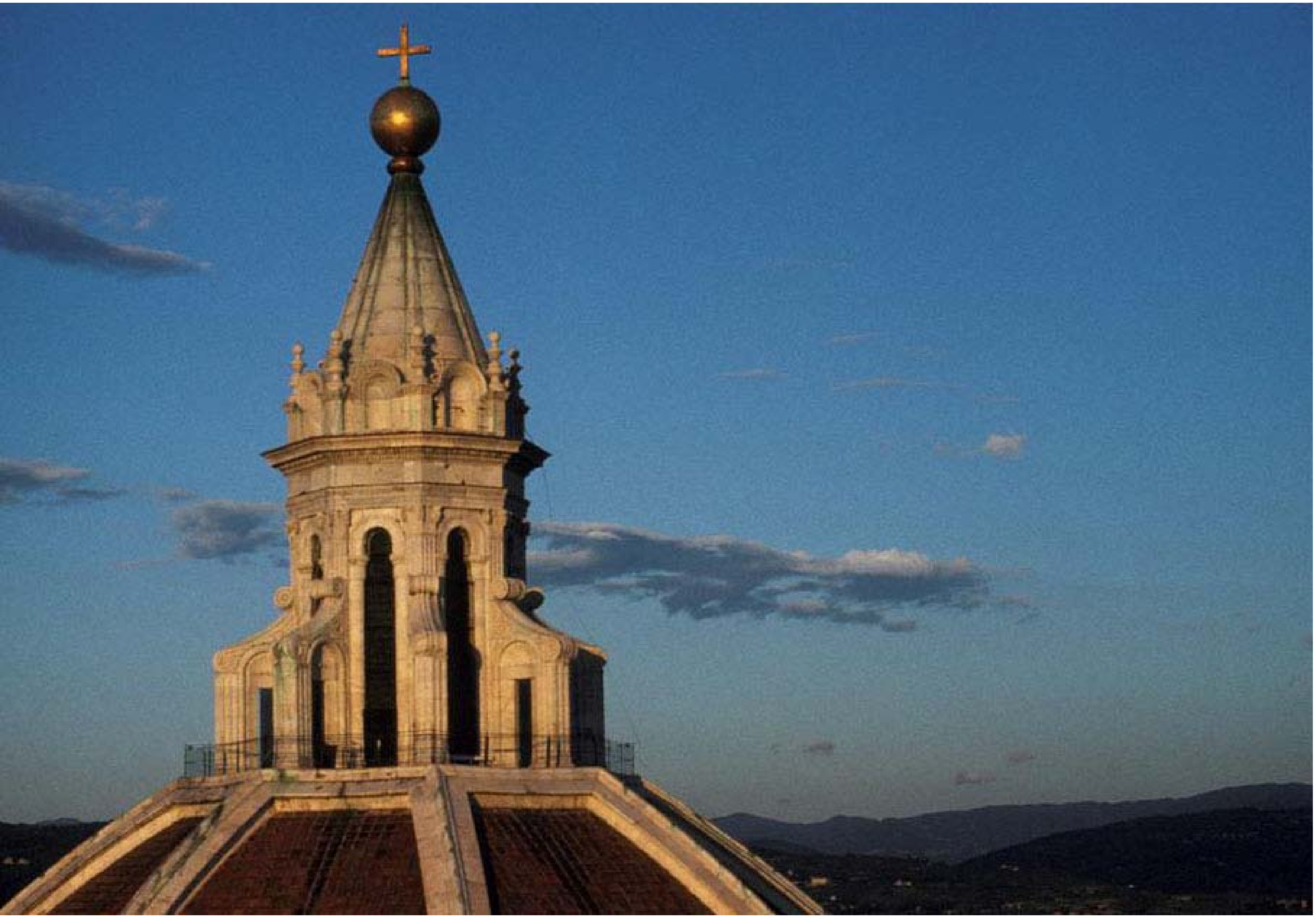
In conclusion …
a few challenges

In conclusion …
a few challenges

- reasoning about prices
  - how to use price information in a service provider
  - how to use price information in a client
  - what prices to set to achieve business objectives

- representing business goals
  - aside: resist the natural slide into *policy rules!*

- trust



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invent