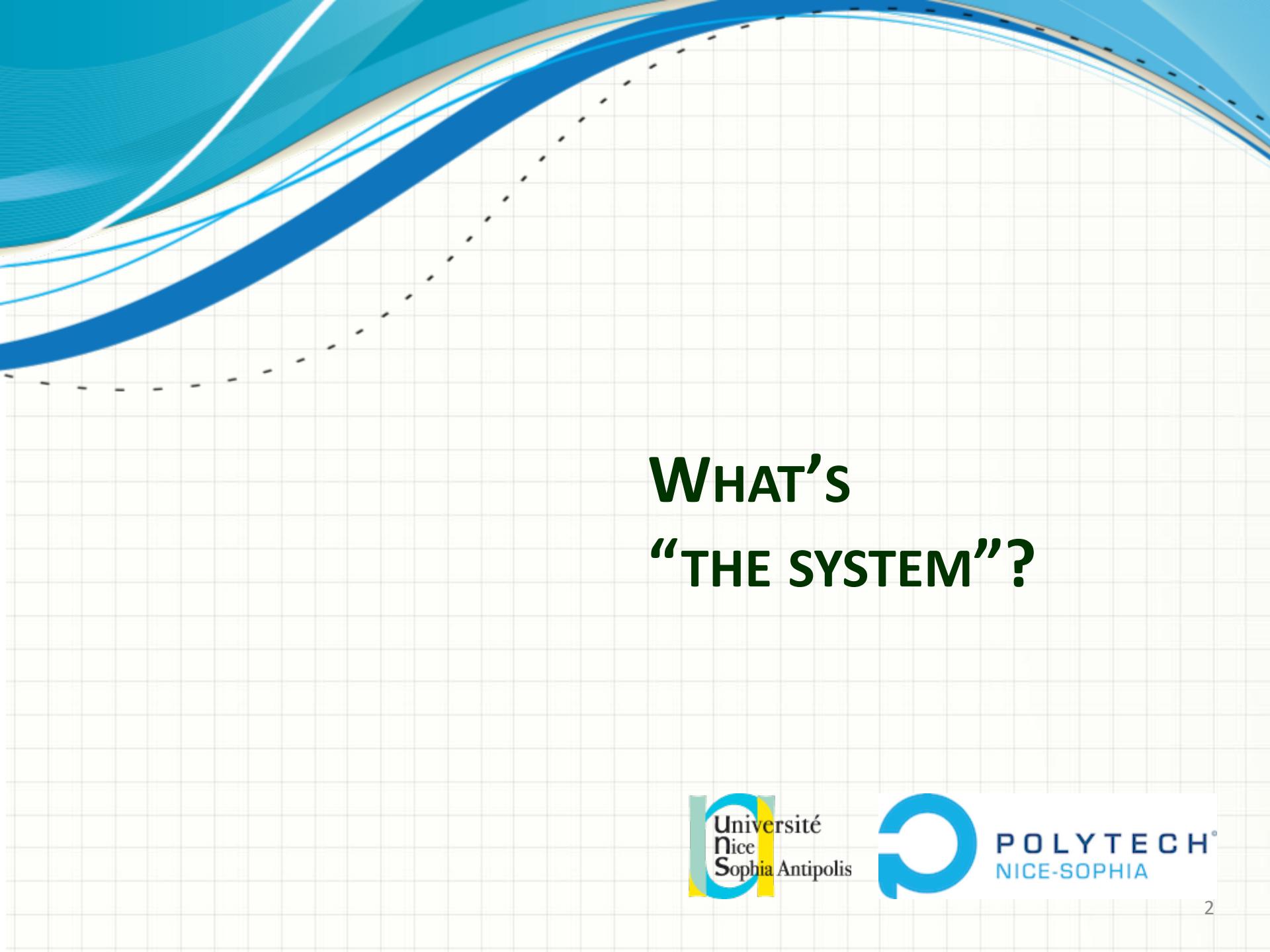


BUILD THE SYSTEM RIGHT

G. Molines
2020-2021





WHAT'S “THE SYSTEM”?



IT System - Definition

- A set of
 - Data and data flows
 - Operations / functions
 - Locations
 - Actors / Users
- A purpose

An IT System

- Should be able to evolve
 - To adapt to new actors, data, operations, etc.
 - Or changing conditions
- Should have a purpose and bring value to end-users
- Is often an heterogeneous combination of applications

SYSTEM FEATURES

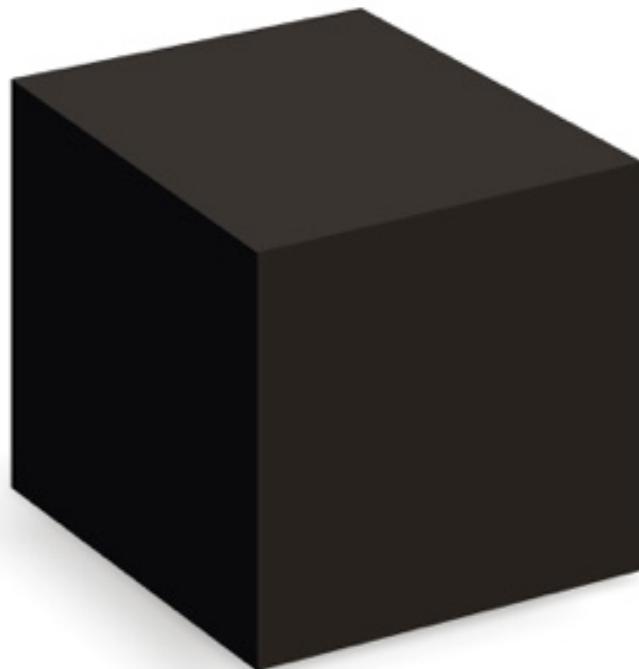


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Characteristics



Performance

- What are some meaningful dimensions?
 - Response times
 - Memory size
 - # concurrent users



Performance

- Can you think of other dimensions?
 - Throughput
 - Power consumption
 - Latency
- Related concept: Online vs batch

Extensibility, scalability

1962: first store

1967: 24 stores

2018: 11718 stores....

2.3 million employees



Extensibility vs scalability ?

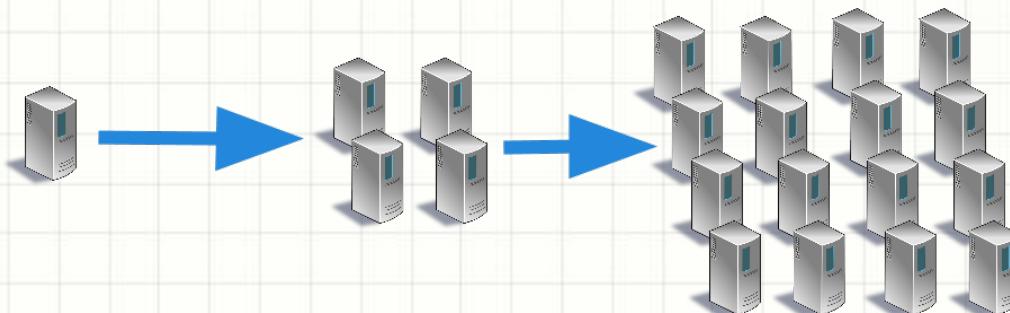
- Extensibility is about adding
 - Features / functions
 - Interfaces to external systems
- With minimal impact to what exists today

Extensibility – how?

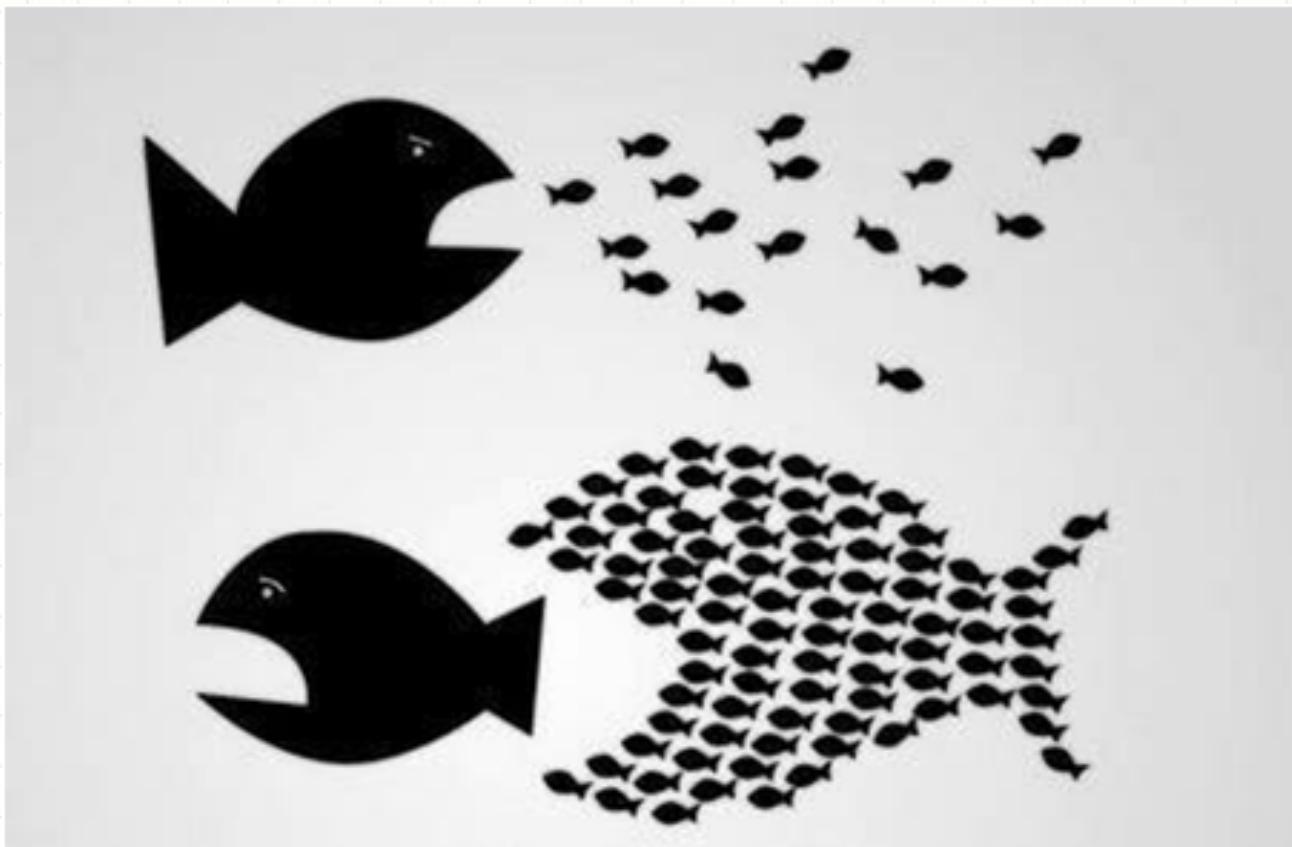
- Extension points
- Documented APIs
 - Contract, lifecycle, maintenance
 - This is hard !
- Plugin framework, SDKs
- Extension in-house vs. done by customers
- Balance open-ness and number of potential product paths
- **Extensible product needs be even more robust !**

Scalability

- Handling higher load
- Vertical
 - (scale up)
- Horizontal
 - (scale out)



Scalability



Resiliency

COUP DE CHAUD - Un incendie dû à la chaleur a provoqué l'interruption des programmes de la chaîne franco-allemande.

C'est une conséquence plutôt inattendue [de la canicule](#). La diffusion d'Arte a été totalement interrompue samedi matin pendant plus de cinq heures à cause d'un incendie dans un local électrique au siège strasbourgeois de la chaîne franco-allemande. Un accident dû à la vague de chaleur, a-t-on appris auprès de la direction.

Panne électrique générale. "Il y a eu une surchauffe et un incendie qui ont entraîné une panne générale de notre système électrique", a indiqué Claude Savin, la chargée de communication de la chaîne.

Les programmes d'Arte diffusés sur la TNT, en France comme en Allemagne, ont été interrompus vendredi matin, et remplacés par un interlude diffusé en boucle. La diffusion normale a été rétablie à 12h26.

Les groupes électrogènes prévus pour prendre le relais de l'alimentation électrique classique ont eu, par l'incendie, ce qui explique l'ampleur de la panne.

Météo France annonçait samedi une température de 37 degrés à Strasbourg, [placée en vigilance orange](#) toute l'Alsace.

Resiliency

- Ability of a system to continue to operate under adverse conditions, or when some of its components are at fault
- How ?
 - Fault tolerance
 - Defensive coding
 - “degraded” mode
 - Modular architecture
 - Plan what can fail
 - “what if” scenarios

HA / DR

- HA = **H**igh **A**vailability
 - Ability for a system to operate (almost) all the time.
 - Measured by percentage of available time
- DR = **D**isaster **R**ecovery

High Availability

- How to achieve this?
 - Make it bullet proof
 - Cluster, load balancing
 - Fast restarts
 - Maintenance while running

Disaster Recovery

- Ability for a system to continue to operate even after some parts of it were taken down by an “unpredictable” event
 - Can be a machine, a network link, a building
 - Events can be nature hazards, third-party outages, acts of war, etc.

Disaster Recovery

- How to achieve this?
 - Backup system
 - Cold standby replica
 - Hot standby replica
 - Dual site system
 - Highly-distributed system (grid structure)

HA / DR



SLA

- Service Level Agreement
- = contract for the service
- Need be measurable, typically some kind of speed metric
 - MTBF
 - MTTR
- Originally a telco concept, but need be understood in a broader sense today
 - Eg: cloud offering availability



Maintainability



- Ability of a vendor to maintain a system once it has been put in production

AUTO RECALL

TOYOTA	HONDA	NISSAN	MAZDA
 TOYOTA	 HONDA	 NISSAN	 mazda
1.7 MILLION VEHICLES	1.1 MILLION VEHICLES	480,000 VEHICLES	45,500 VEHICLES



Coupling

- The degree to which two modules are inter-dependent

Loose
Low interdependency
Low coordination
Low semantic



Tight
High interdependency
High coordination
High semantic

Which is best?

Coupling – how?

- APIs
 - Module A exposes a public API
 - Through interfaces
 - Module B uses it
 - Need the interface definition to compile
 - Need same JDK/compiler version on both modules

Coupling – how?

- SOAP over http
 - Very loose
 - Discoverability of web services
 - Slow performance
 - Parsing XML is always a mess

Coupling – how?

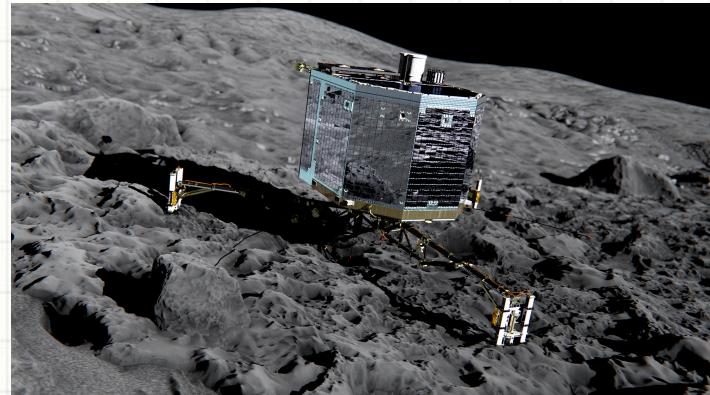
- REST APIs
 - Becoming de facto standard
 - Querying entities, simple operation
 - Composable easily
 - Also very loose

Coupling – how?

- Through persistence
 - Eg: write a file in a directory / a DB record that the other module is polling
- Through message queues
 - Async, but still tight, dependent upon data format

Coupling considerations

- Stateless vs. stateful
- Sync vs. async
- Message loss
- Serialization formats:
 - Eg; rmi, json, xml, csv, binary
- Performance, network



Coupling considerations

- Importance of interfaces
 - They are a CONTRACT
- Integrate early to detect issues
- Walking skeleton !

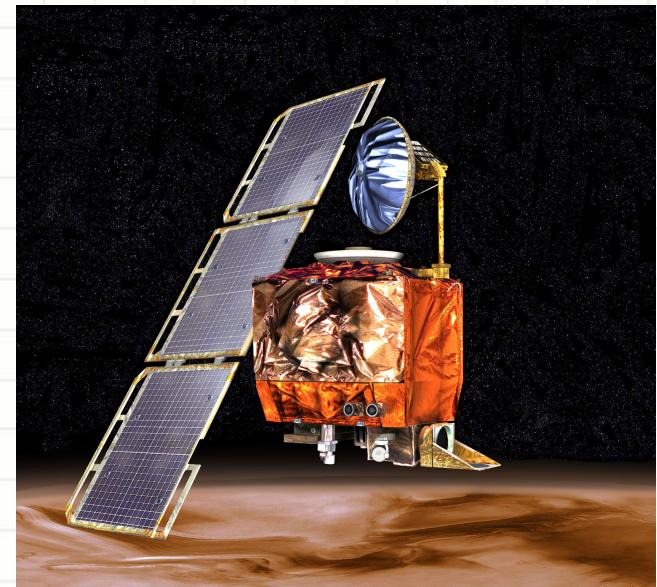
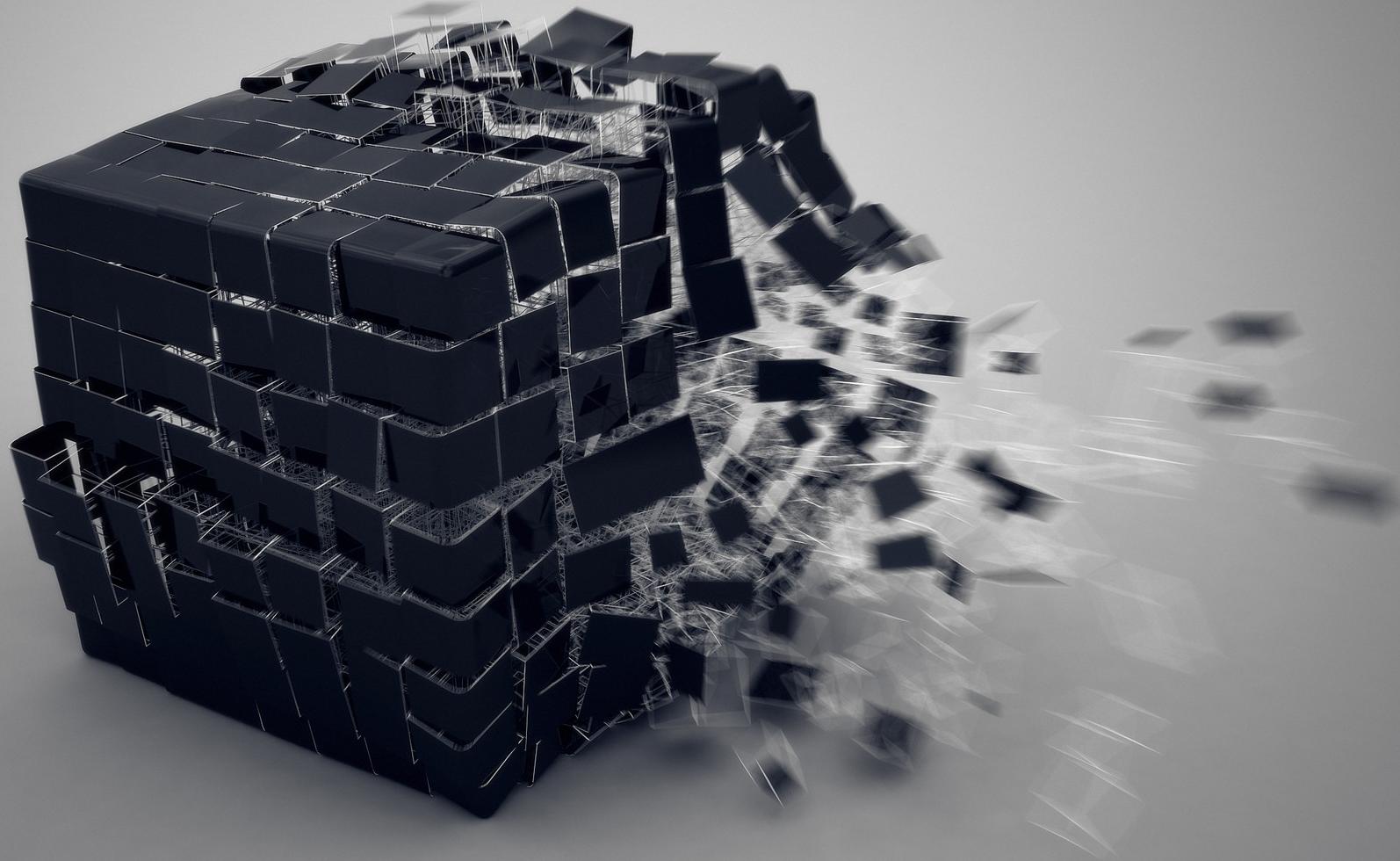


Image by NASA/JPL/Corby Waste



Programming language choice

- Runs on which hardware/platform?
- Interpreted vs. compiled
- Strongly typed?
- Which systems do we interface with?
- Market constraints
- Who is programming?

Choice of technology

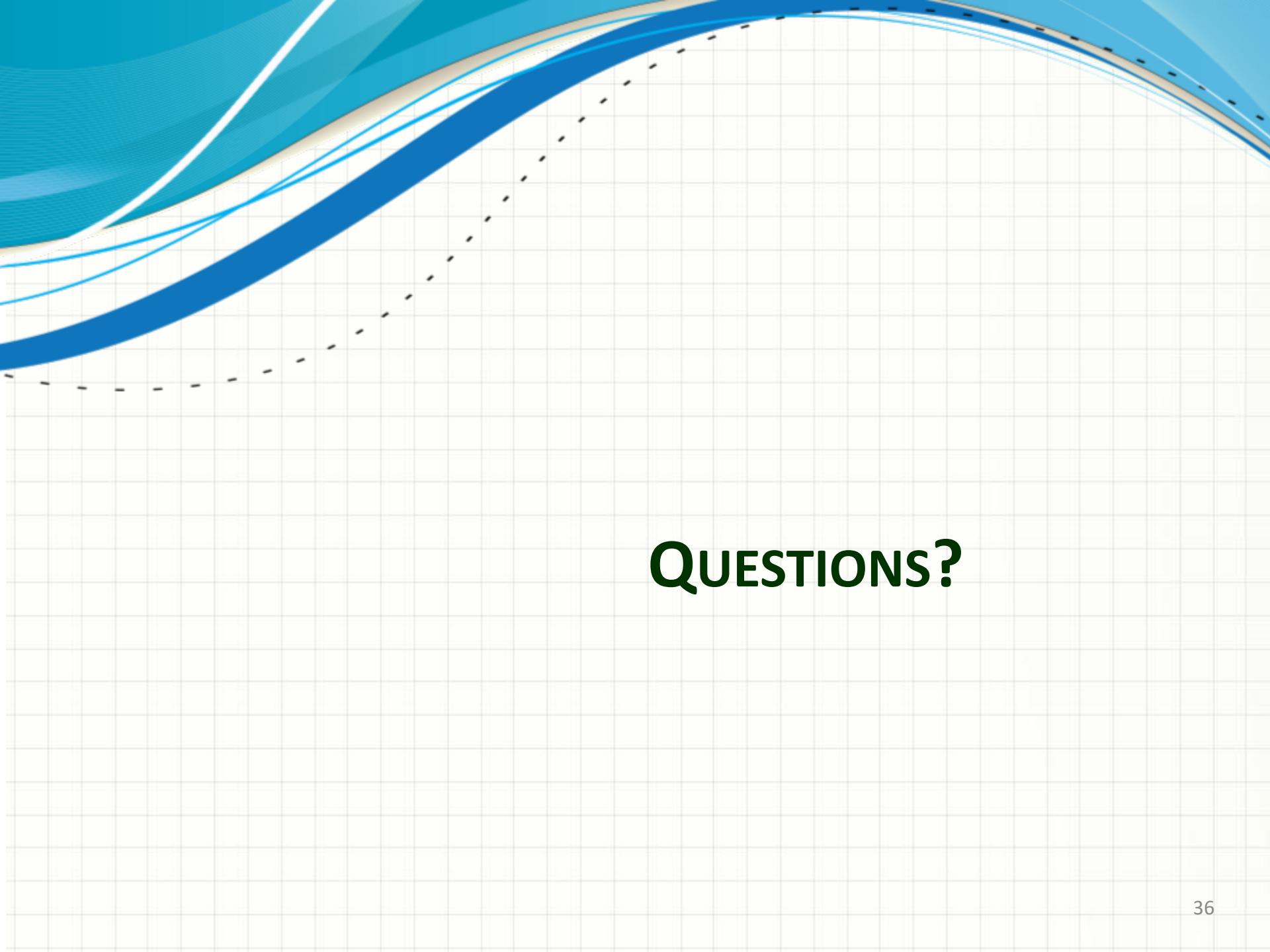
- Define the purpose
- Establish a list of weighted criteria
- Survey market
 - Also include a few out of the box thinkers
- Download trial version, kick the tires
 - → come up with shortlist
- Conduct deeper evaluation
 - Establish technology limits

Choice of technology - Example

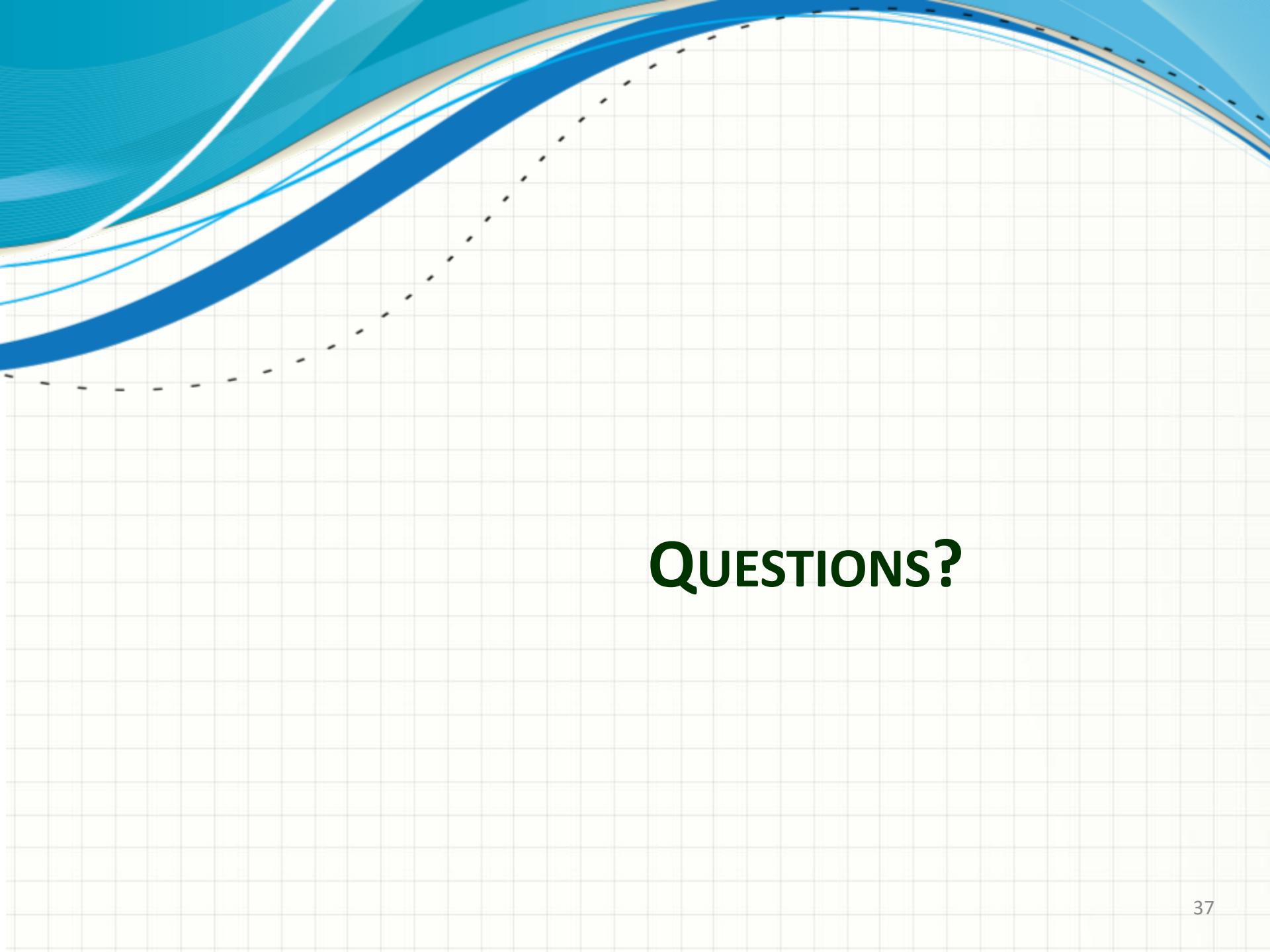
- Purpose: store tennis scores
- Criteria
 - Can handle volume of x tps (5)
 - Can be integrated easily with our object model written in language x (2)
 - Can scale up to x GB / year / 10 years (3)
 - Cost less than \$10k (1)
 - Offers replication solution (3)
 - ...
- Survey market: Oracle, DB2, MySQL, etc.
 - “out of the box”: Mongo DB
- Download trial version, kick the tires
 - → come up with shortlist
- Conduct deeper evaluation
 - Establish technology limits

Choice of technology - Criteria

- Include criterias on:
 - Technical side
 - Costs: one shot, maintenance
 - Licensing
 - Support
 - Vendor reputation, resilience
 - Ability to switch to another vendor easily
 - Potential evolutions
- Evaluate cost of building it yourself vs. acquiring it



QUESTIONS?



QUESTIONS?

APPENDIX