KLEIS TECHNOLOGY

LCA AS CODE

Bring Software Practices to LCA Data Engineering

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ROBUST SCALE-UP

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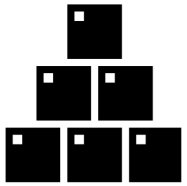


MORE ASSESSMENTS

- 1’000+ product footprints
- Higher resolution

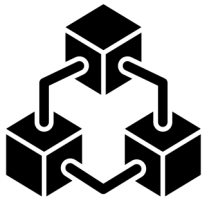
MORE FREQUENTLY

- Every year
- Every month, day

MORE COLLABORATION

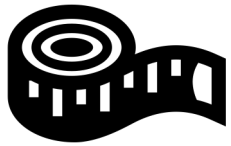
- Combine external datasources
- Collaborate with domain experts

AND



ROBUST

- Correct results
- Reproducible conclusions



FLEXIBLE

- Easy to fix
- Easy to evolve, iterate

RELIABLE

- Transparent methodologies
- Chain of trust

SEPARATE CONCERNS

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1 PARAMETRIZED MODEL

1'000+ SCENARIOS

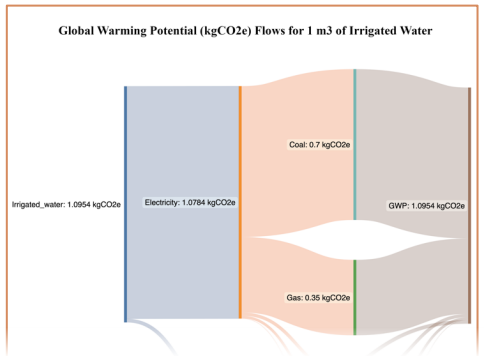
irrigation.lca

```
process irrigation {

    products {
        1 m3 irrigated_water
    }

    inputs {
        2.0 kWh electricity
        1.0 p sprinkler
    }
}

process electricity_mix {
    products {
        1 kWh electricity
    }

    variables {
        from_coal = 35 percent
        from_gas = 22 percent
        from_hydro = 15 percent
        from_nuclear = 9 percent
```

	country (1)	year...	from_fossil (3)	from_hydro (4)	from_nuclear (5)	from_wind (6)	from_coal ...	from_oil (8)
72	Africa (BP)	2003	0.8054932340661	0.16319734393078122	0.025031440213290408	0.006277981789828462	0.4644901655012827 5	0.3410030685648172
73	Africa (BP)	2004	0.8057498917868755	0.16234988574707324	0.024873919127047242	0.007026303339004038	0.4564077269204055 4	0.34934216486646996
74	Africa (BP)	2005	0.8134085855994527	0.1594684051147396	0.020271833720661176	0.006851175565146531	0.4466443324379521	0.36676425316150063
75	Africa (BP)	2006	0.8168014972228931	0.158003300330033	0.017205988891572082	0.007989213555501891	0.4392658778072929	0.37753561941560015
76	Africa (BP)	2007	0.8175863318039122	0.15684617242212026	0.018644852290107063	0.006922643483860583	0.4324337921597038	0.38515253964420837
77	Africa (BP)	2008	0.8152228543857181	0.15631973623369055	0.020958565368094	0.007498844011982068	0.4150901670653988	0.40013268732031926
78	Africa (BP)	2009	0.8122856596904449	0.15891102551466818	0.020435871390785756	0.008367443404101255	0.3953617008437825	0.4169239588466606
79	Africa (BP)	2010	0.8094026548672566	0.16100160901045 86	0.020223250201126308	0.009372485921158 49	0.3847043443282382	0.4246983105390184
80	Africa (BP)	2011	0.8094561361070796	0.16170778906627 96	0.018837687469762 94	0.009998387356877922	0.3795859538784067	0.42987018222867285
81	Africa (BP)	2012	0.8167482436656381	0.15471823271053398	0.018040744947083832	0.010492778676744023	0.3554881051690000 3	0.46126013849663 81
82	Africa (BP)	2013	0.8105204983922829	0.15858118971061094	0.019011254019292604	0.011887057877813505	0.3388565112540193	0.47166398713826363

Parametrized model as code

- LCA natural language
- Independent of data sources



INSIGHTS

Data fed into the model

- Managed independently from the model

IN PRACTICE - CLOUD ASSESS

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CloudAssess

a joint-venture by

resilio KLEIS TECHNOLOGY

testing with EXOSCALE

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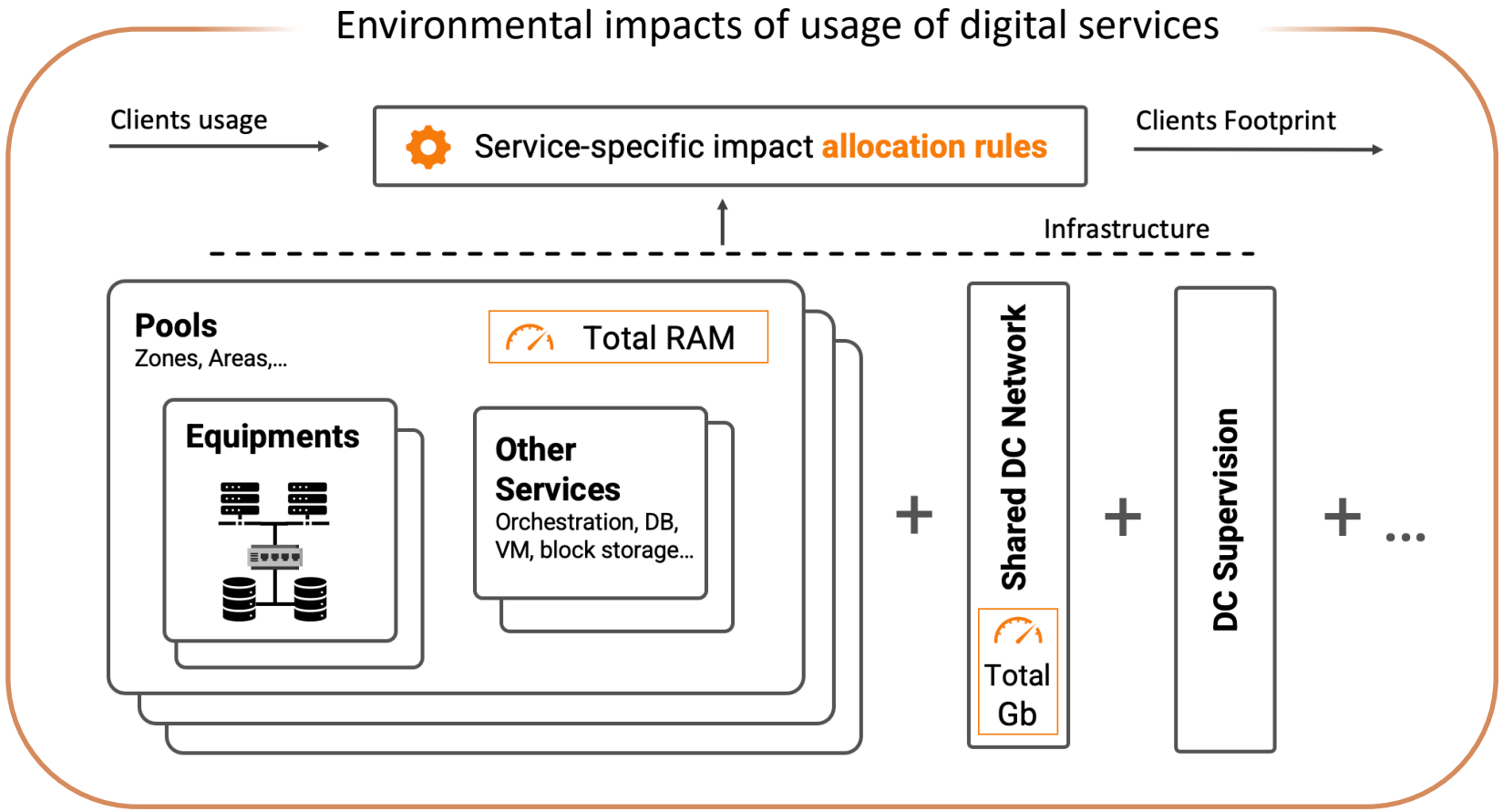

IN PRACTICE - EXAMPLE

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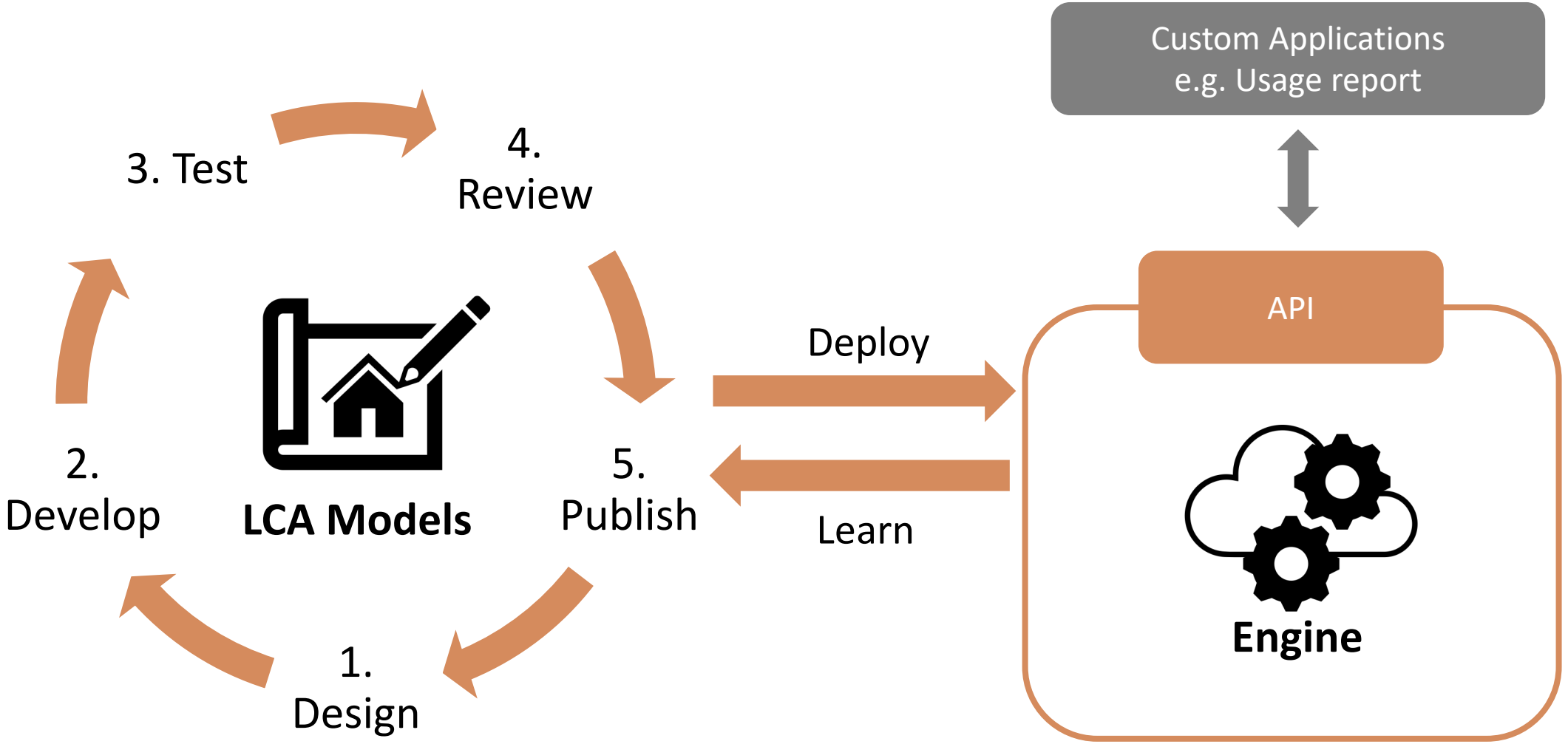
virtual_machine.lca

```
process virtual_machine {
    params {
        id = "vm"

        ram_size = 16 GB * hour
        storage_size = 100 GB * hour

        n_clients = 10 piece * hour
        internal_ram = 32 GB * hour
        internal_storage = 100 GB * hour
    }
    products {
        1 hour vm
    }
    inputs {
        ram_size pool_ram from pool_ram
        storage_size pool_storage from pool_storage
        1 hour workload from internal_workload(
                    n_clients = n_clients,
                    ram_size = internal_ram,
                    storage_size = internal_storage,
                    )
    }
}
```

IN PRACTICE – ITERATIVE DESIGN



IN PRACTICE - COLLABORATION

1. Alice submits a change

05.09.23	Blanchard	1	1	process internal_workload {
05.09.23	Blanchard	2	2	params {
05.09.23	Blanchard	3	3	n_clients = 10 piece * hour
		4		ram_size = 32 GB * hour
Yesterday	Blanchard		4	ram_size = 64 GB * hour
05.09.23	Blanchard	5	5	storage_size = 100 GB * hour
05.09.23	Blanchard	6	6	}
05.09.23	Blanchard	7	7	products {
05.09.23	Blanchard	8	8	n_clients workload
05.09.23	Blanchard	9	9	}
05.09.23	Blanchard	10	10	inputs {
05.09.23	Blanchard	11	11	ram_size pool_ram from pool_ram
05.09.23	Blanchard	12	12	storage_size pool_storage from pool_storage
05.09.23	Blanchard	13	13	}
05.09.23	Blanchard	14	14	}

- Traceability of changes
- Compare versions

2. Peers review the change

3. On approval, the change is committed

KEY TAKE-AWAY

LCA issues are similar to what the software industry have faced.

The As-Code approach is the key enabler of bringing these battle-tested practices and experiences to the LCA world.

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THANK YOU.

https://lca-as-code.com

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