Architectural Views: The State of Practice in Open-Source Software Projects

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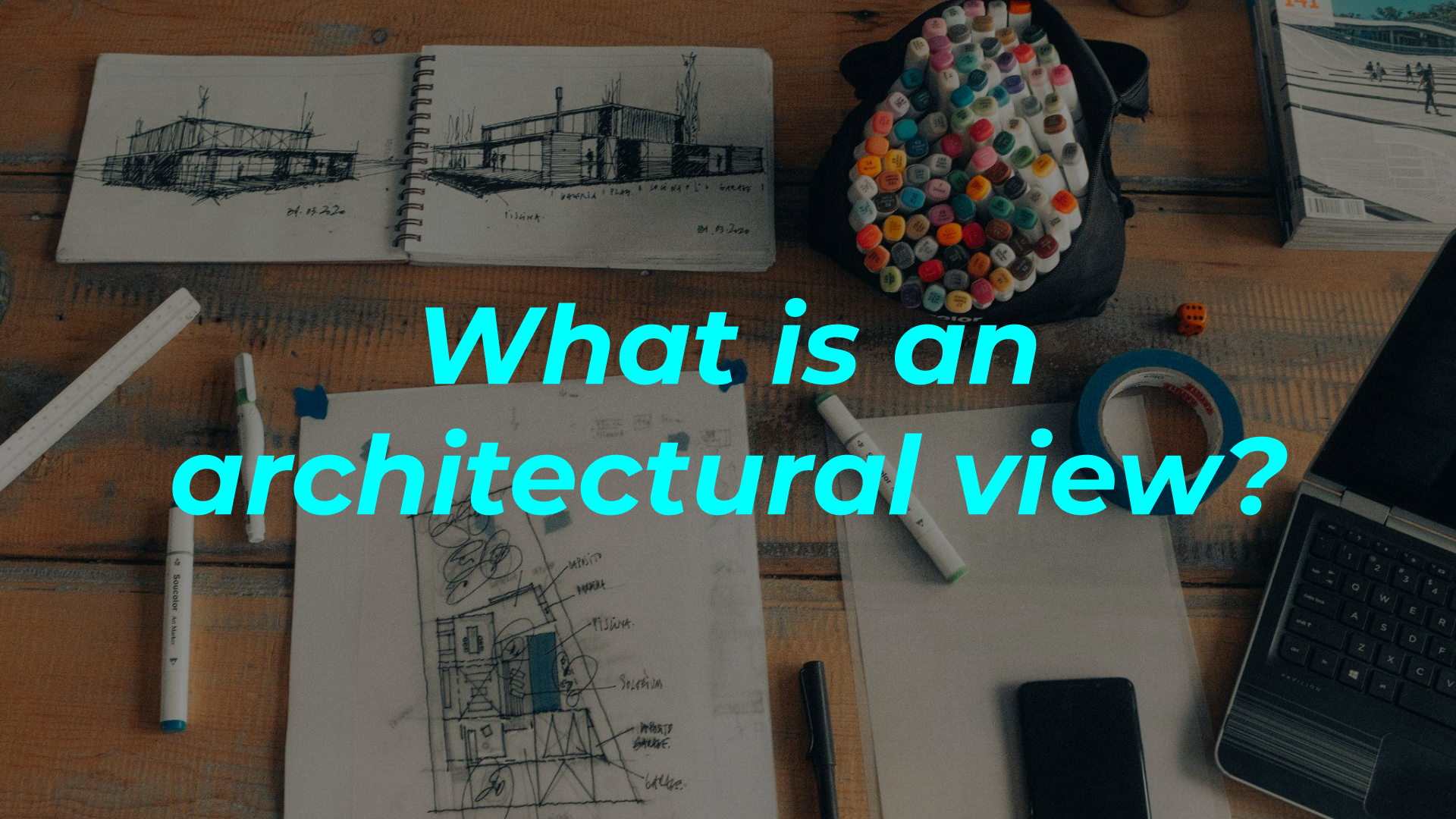
What is an architectural view?

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*Representation of a set of **system elements and relations** associated with them*

Clements, P., Garlan, D., Little, R., Nord, R. and Stafford, J., 2003, May. Documenting Software Architectures: Views and Beyond. In 25th International Conference on Software Engineering, 2003. Proceedings. (pp. 740-741). IEEE.

What is an architectural view?

*One of the **primary methodologies** to design and communicate software architectures*

Clements, P., Garlan, D., Little, R., Nord, R. and Stafford, J., 2003, May. Documenting Software Architectures: Views and Beyond. In 25th International Conference on Software Engineering, 2003. Proceedings. (pp. 740-741). IEEE.

What is an architectural view?

*Effectively **documenting** **an architecture** is **as** **important as crafting it***

Clements, P., Garlan, D., Little, R., Nord, R. and Stafford, J., 2003, May. Documenting Software Architectures: Views and Beyond. In 25th International Conference on Software Engineering, 2003. Proceedings. (pp. 740-741). IEEE.

There must be a lot of studies on how architectural views are documented

Goal

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Understand ***how and for what architectural views are used*** in open-source practice

Goal

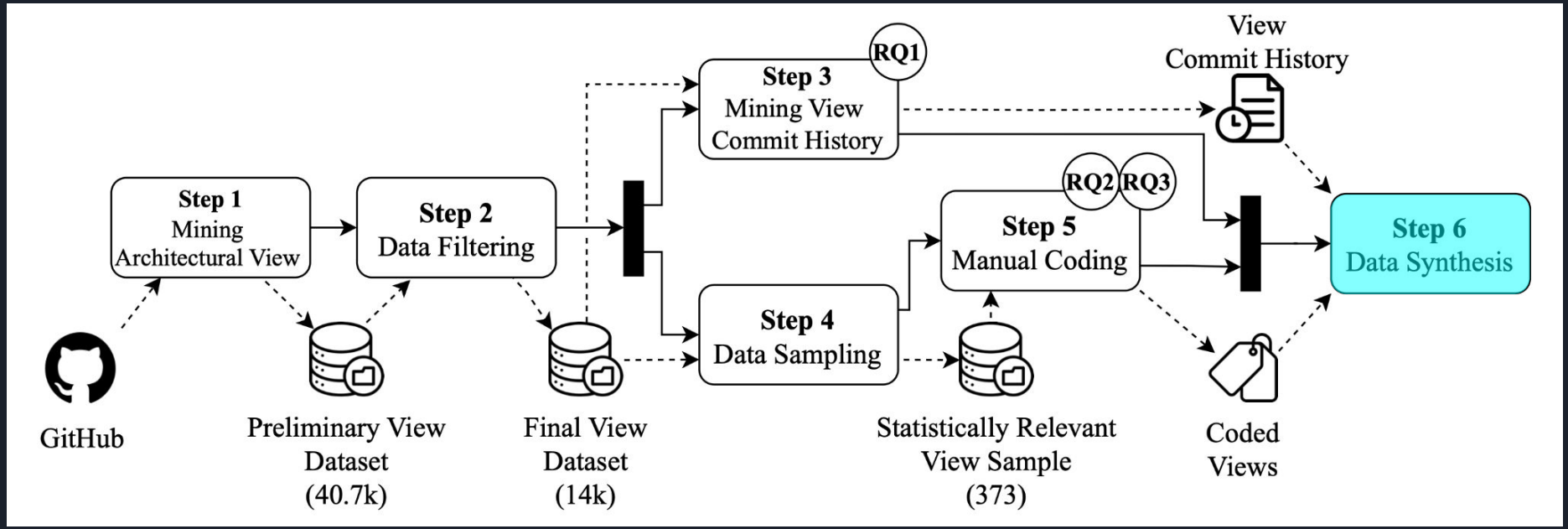
RQ_1: What is the view **history?**

RQ_2: What is the view **syntax?**

RQ_3: What is the view **content?**

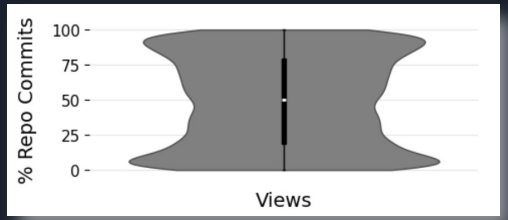

Research process
overview

Research process overview

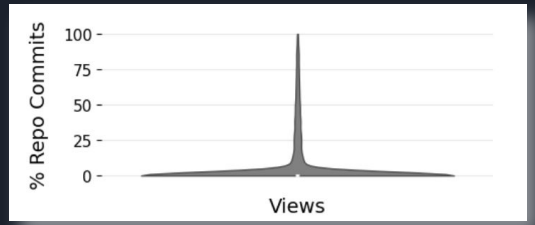


Results

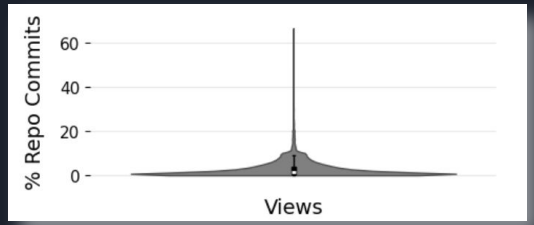
Results RQ_1: History of Architectural Views



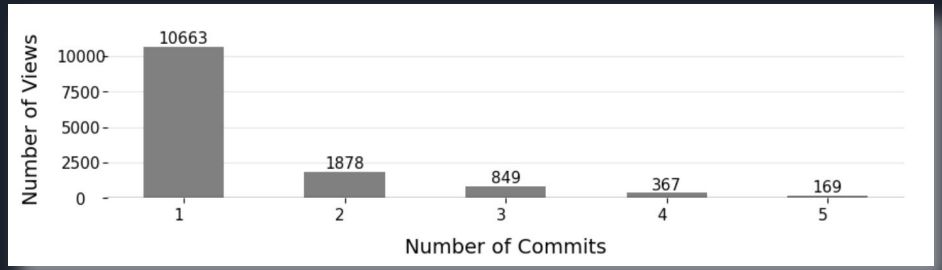
Views are most **introduced** either at the **start or end of projects**



75% of views are **never updated. Edits closely follow each other**

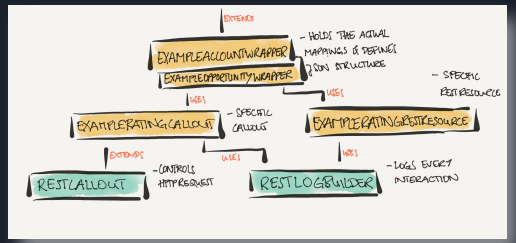


Only **very few of commits focus on views**

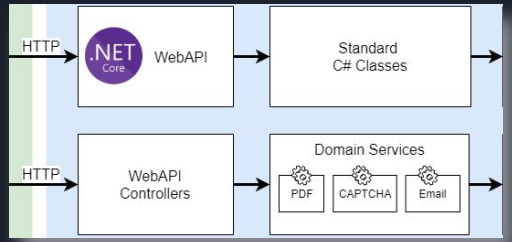


Creating and **editing views** is the **responsibility** of a **single person**

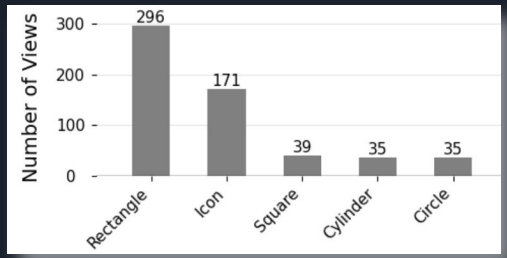
Results RQ_2: View syntax



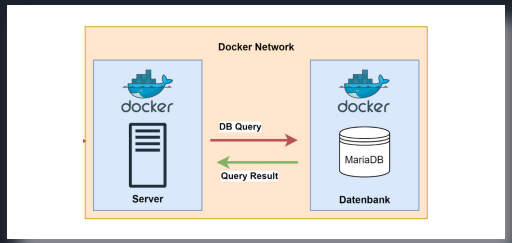
96% of views uses an informal notation (only 4% UML or similar)



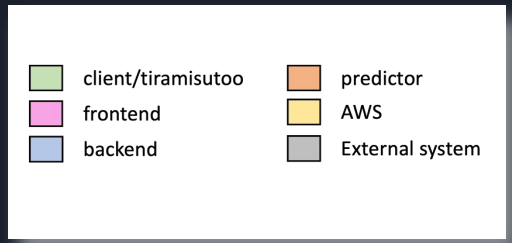
Views use explicit connectors (92%), mostly unidirectional (74%)



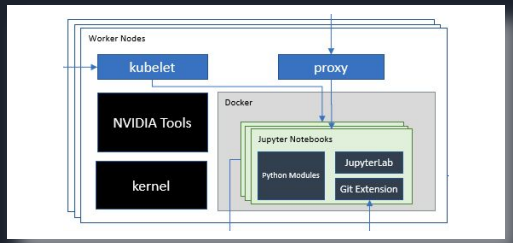
Recurrent rectangle (79%) and icon shapes (46%)



81% of views use colors

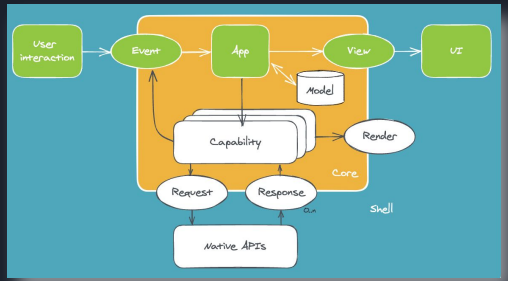


Legends are seldom used (8%)

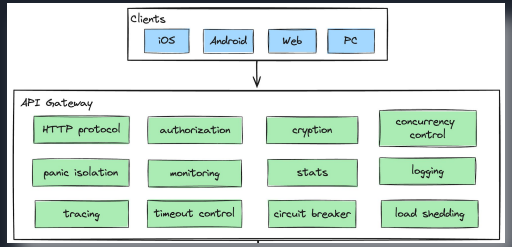


Nested components are common (56%)

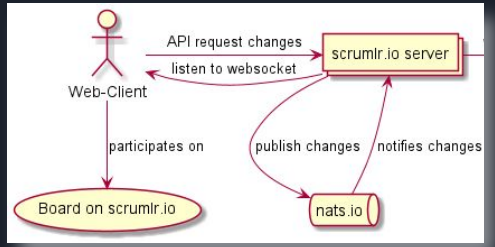
Results RQ_3: Scope, style, and concerns



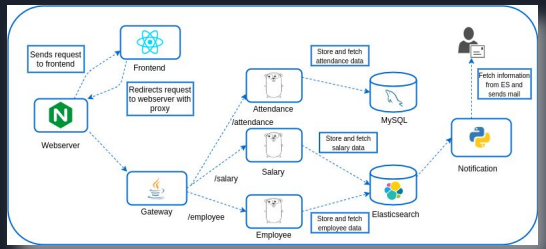
Most views consider the **entire architecture (53%)**



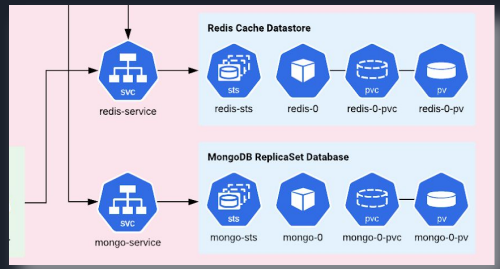
Recurrent **styles: Client-server (20%), Layered (20%), Service-oriented (15%)**



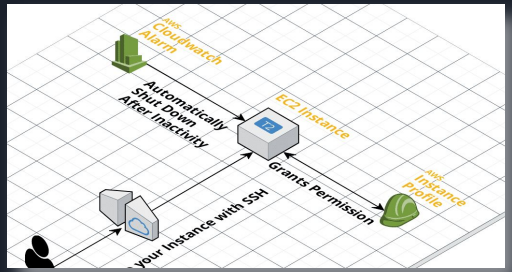
Granularity often **high (53%)** or **medium (37%)**



Either **static (49%)** or **dynamic (42%)** aspects

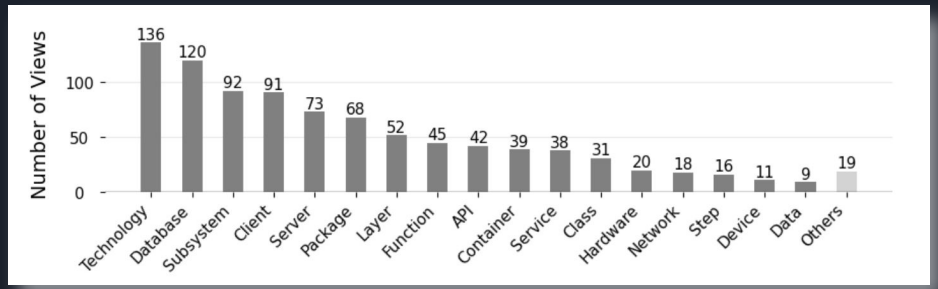


Concerns are often **documentation (30%), deployment (30%)** and **control flow (29%)**

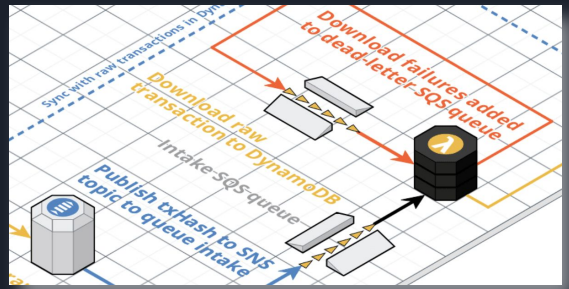


QAs: Maintainability (68%), function suitability (35%), performance (32%), security (9%)

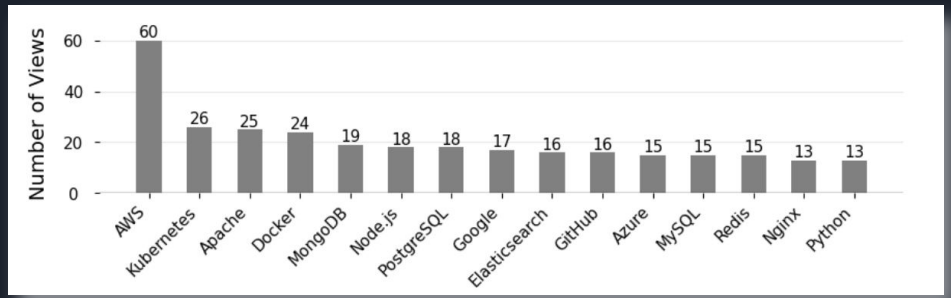
Results RQ_3: Technologies, connectors, and overlays



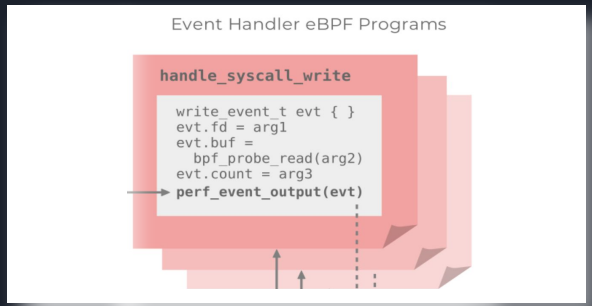
Components are mostly **technologies (36%)**, **databases (24%)**, and **subsystems (24%)**



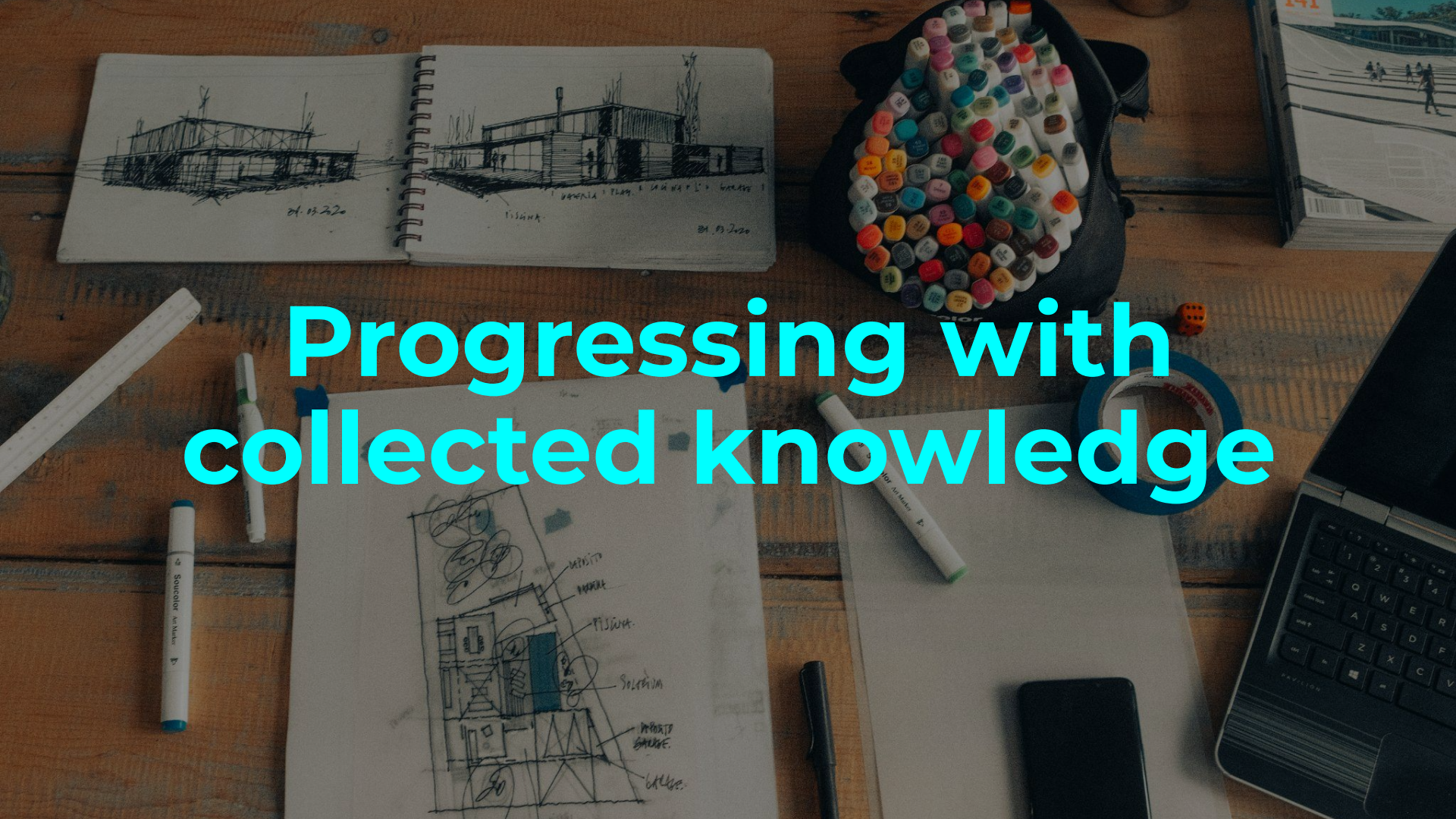
Connectors are frequently **control flow (28%)**, **generic (27%)**, and **data flow (25%)**



35% views report at **least one technology**, with a maximum of 10 technologies per view



Design overlays are seldomly used **(18%)**. Mostly **text (17%)**, **screenshots (12%)**, **URLs (10%)**, and **code (9%)**


Progressing with collected knowledge

State of practice is far from ideal

Views are:

- **One** per project
- **Seldom updated**
- Mostly using **informal notation**
- **High level granularity**
- Using ***ad hoc*** **custom notation**
- **Not based on well established practices**

Potential causes:

- Views are **hard to create and maintain**
- **Value** of views is **not recognized**
- **Lack** of **intuitive templates**

What can we do to ease the adoption of architectural views in open-source practice?

Potential answers:

- **Make views versionable** (e.g., by encouraging adoption of view file formats)
- **Move away from immutable hard-coded images** (e.g., by rendering architectural views in repository web interfaces)
- Provide **intuitive view templates, icon sets, and connectors** implying **syntactic consistency**
- **Integrate view editing** in **collaborative programming environments** (e.g., **dedicated GitHub Actions**)
- Long-term aspiration:

  Establishment of ***`ARCHITECTURE.md`*** *files*