

# Q\*cert

## A Platform for Specifying and Verifying Query Compilers

J. Auerbach, M. Hirzel, L. Mandel, A. Shinnar, J. Siméon  
IBM Research

### Goals:

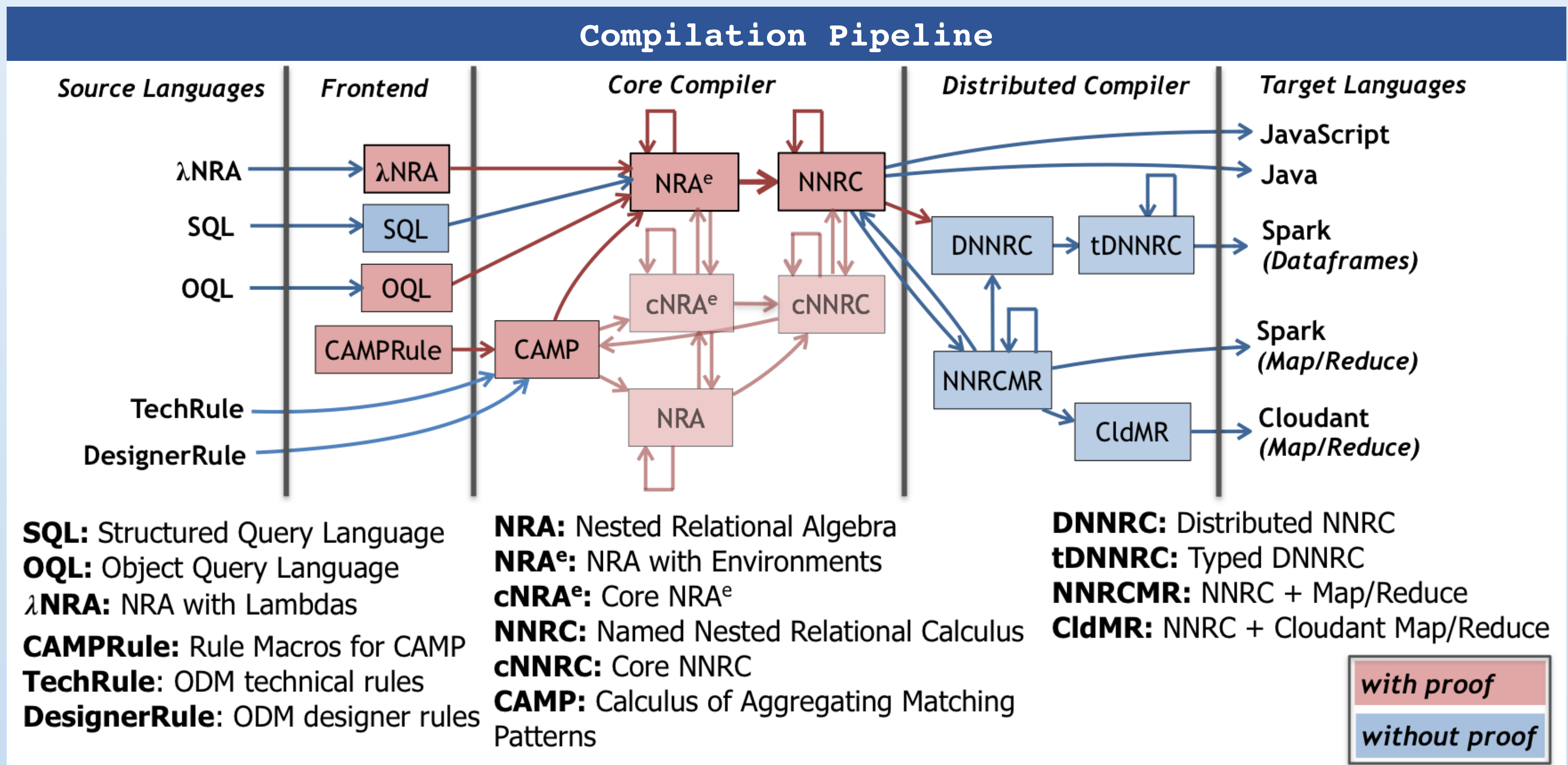
Verified Query Compiler  
Multiple Sources & Targets  
Extensibility

### Applications:

New Languages (e.g., DSLs)  
Designing New Optimizations  
Education Platform

### Approach:

Written in Coq (Proof Assistant)  
Mechanized Correctness Proof  
Compiler Extraction



### Algebraic Equivalence

```
Lemma select_union_distr q0 q1 q2 :
   $\sigma(q_0)(q_1 \cup q_2) \equiv \sigma(q_0)(q_1) \cup \sigma(q_0)(q_2)$ .
Proof.
... (* proof omitted *)
Qed.
```

### Functional Rewrite

```
Definition select_union_distr_fun q :=
  match q with
  | NRAEnvSelect q0 (NRAEnvBinop AUnion q1 q2) =>
    NRAEnvBinop AUnion
      (NRAEnvSelect q0 q1) (NRAEnvSelect q0 q2)
  | _ => q
end.
```

### Correctness Proof

```
Property select_union_distr_fun_correctness q0 q1 q2 :
  select_union_distr_fun q  $\equiv$  q.
Proof.
Hint Rewrite select_union_distr : envmap_eqs.
prove_correctness q.
Qed.
```

### Other Features

Configurable Optimizer  
Nested Data Model with Objects  
JSON Support  
Aggregate Queries (supports TPC-H)  
Type Checking  
Foreign Types and Operations

### Compiler Extraction

