

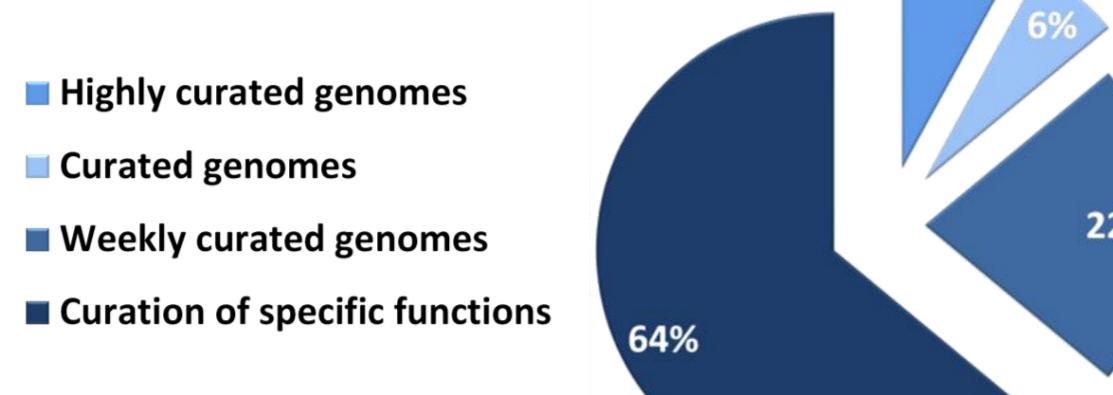
The MicroScope platform: from data integration to a rule-based system for massive and high-quality microbial genome annotation

Jonathan MERCIER, Alexandre RENAUX, Adrien JOSSO, Aurélie GENIN-LAJUS, E'Krame JACOBY, François LE FEVRE, Guillaume ALBINI, Claude SCARPELLI, Claudine MEDIGUE, David VALLENET – CEA, Genoscope, LABGeM



MicroScope features

- High throughput automatic (re)-annotation of microbial genomes
- Expression and evolutionary studies by NGS data integration
- Function and biological process predictions
- Data exploration functionalities (comparative genomics, metabolism)
- Tools to assist curators in the evaluation of all available data
- Support to MicroScope users



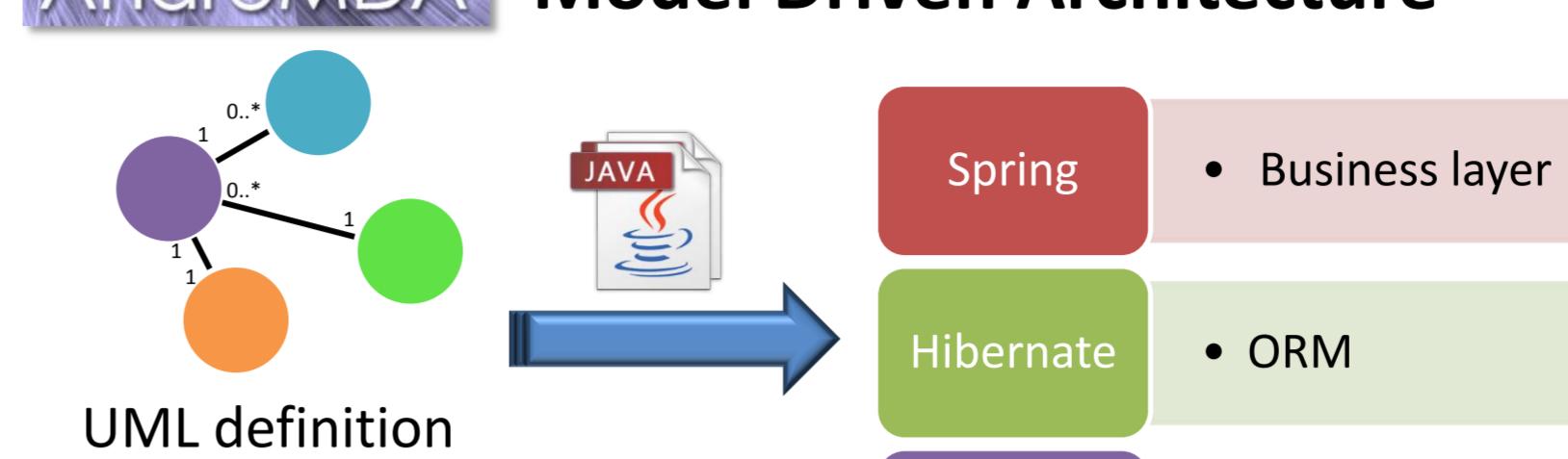
Statistics

- 1,900 user accounts / 300 active accounts per month
- >2,900 genomes corresponding to >4,900 sequences
- 2013: 593 new analyzed genomes
4 genomes per day in 2014
- 4,400 human-expertized annotations per month
- More than 340 citations

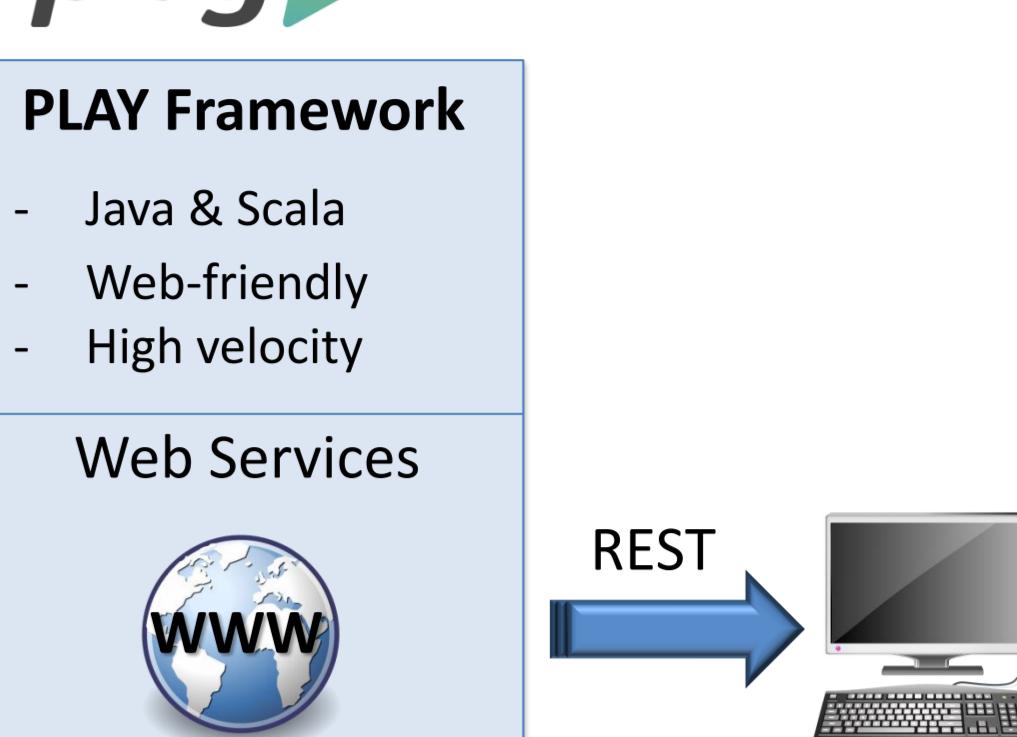
"MicroScope: an integrated microbial resource for the curation and comparative analysis of genomic and metabolic data", Vallenet et al., *Nucleic Acids Res.*, 2013

IT tools and concepts

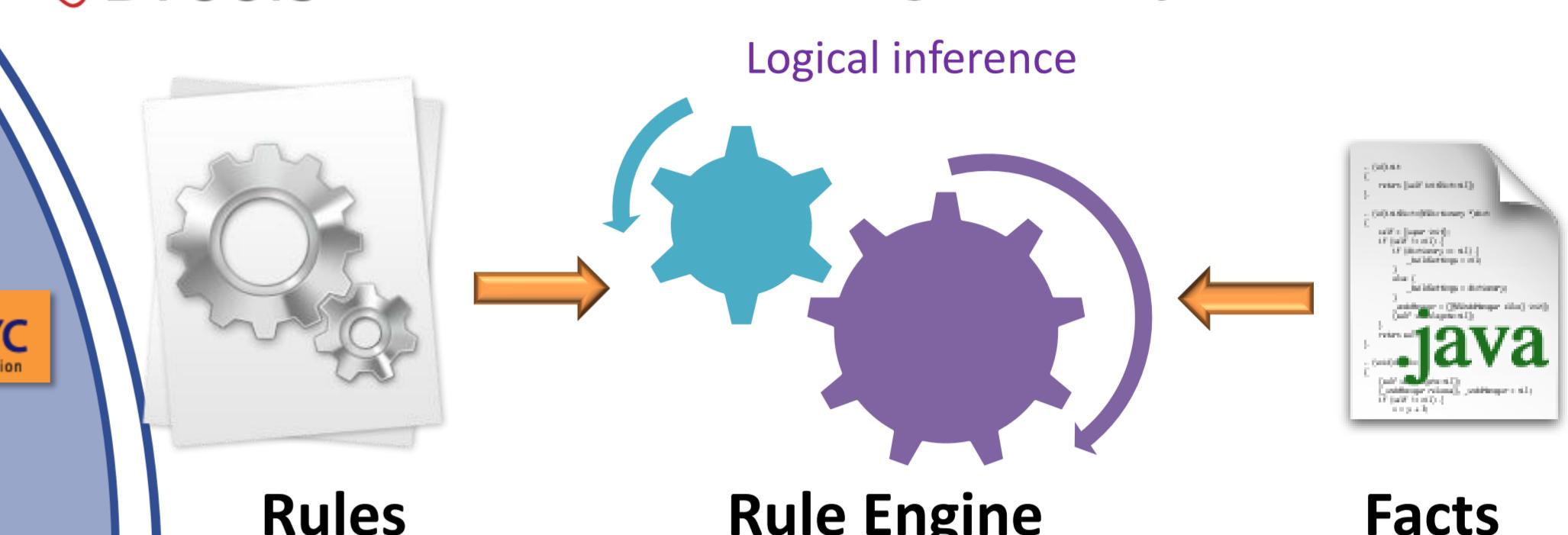
AndroMDA Model Driven Architecture



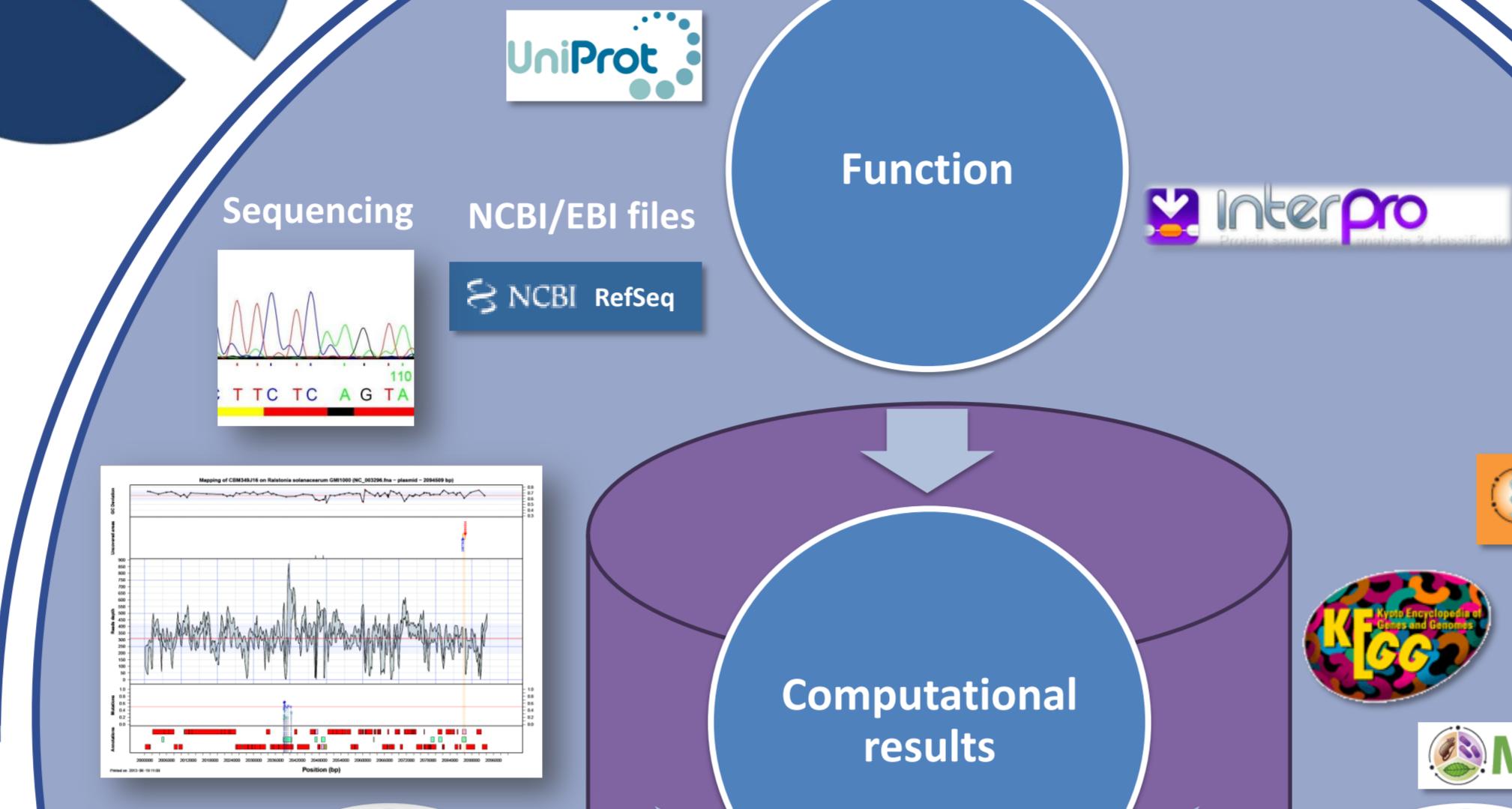
play Web Services



Drools Business Rule Management System



Function

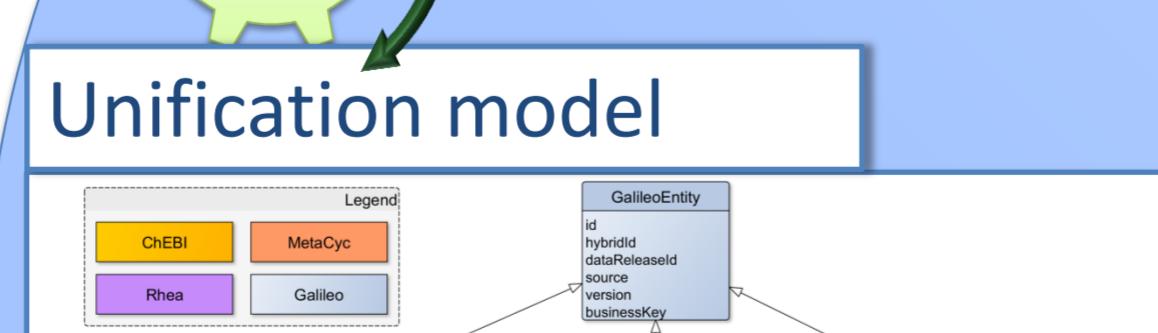


Databases

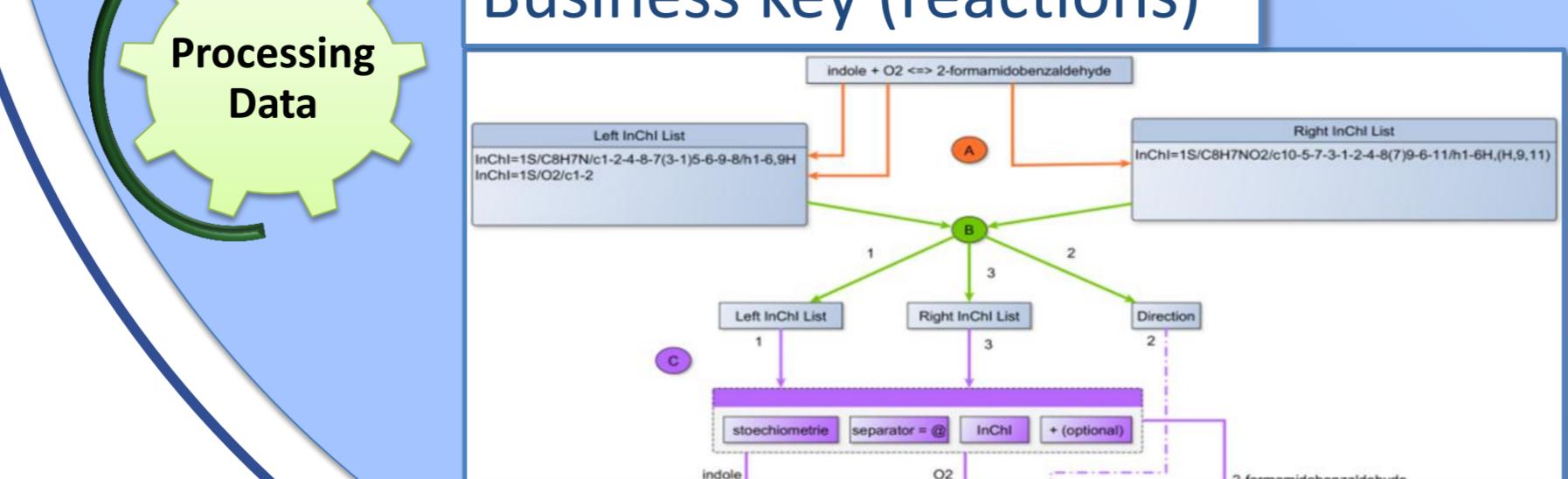
current MicroScope World enhancements

Galileo

Unification model



Business key (reactions)



Production System

Genome Annotation

Annotation Rules

Functional annotation rules
UniRule: HAMAP + PIRSF + RuleBase



Biological Facts

present	require	avoid	state
yes	yes	yes	ambiguous
yes	yes	no	normal
yes	no	yes	unexpected
no	yes	no	orphan
no	yes	yes	ambiguous
no	no	yes	missing
no	no	no	normal

Annotation Rules

Consistency against biological processes

```

rule "Missing state"
when
$fact: Fact( present == "no", require == "yes", avoid == "no" )
then
modify( $fact.setState("missing") );
end
    
```

```

rule "require Pathway"
when
$org: Organism()
$path: Pathway(org == $org)
then
Fact fact = new Fact($org, $path);
fact.setRequire("yes");
insert(fact);
end
    
```

Pathway Rules

Grools

Knowledge Base

Rule Engine

Primary Data

Processing Data

Business key (reactions)

Unification model

Annotation Rules

Pathway Rules

Knowledge Base

Rule Engine

Biological Facts

Annotation Rules

Pathway Rules

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