

ID SURFACE SYNTAX

---

TEXT STRUCTURE

- 1

Line terminator normalization

The character sequence CRLF, and the single characters CR, LS, and PS, are all converted to a single LF character, in all source contexts, before tokenization takes place.
- 2

Cf stripping (Compatibility Note)

Format Control characters (category Cf in the Unicode database) will no longer be stripped from the source text of a program [see Ecma-262 section 7.1]
- 3

Byte order mark (BOM) handling

The character sequences for BOM shall be replaced with a single white space character before tokenization takes place.
- 4

Unicode escapes

The escape sequence of the form `\u{n..n}` will be replace by the unicode character whose code point is the value of the hexadecimal number between `{` and `}`

LEXICAL STRUCTURE

- 1

ReservedIdentifier [one of]

`break case cast catch class const continue debugger default delete do dynamic else false final finally for function if in instanceof interface is let like namespace native new null override return static super switch this throw true try type typeof use var void while with yield __proto__`
- 2

ContextuallyReservedIdentifier [one of]

`each extends generator get implements set standard strict undefined`
- 3

Punctuator [one of]

`. < ... ! != !== % %= & &= && &&= * *= + += ++ - -= -- / /= < <= << <<= = == === > >= >== >> >>= >>> >>>= ^ ^= | |= || ||= : :: ( ) [ ] { } ~ , ; ?`
- 4

VirtualSemicolon

[If the first through the  $n^{\text{th}}$  tokens of an ECMAScript program form are grammatically valid but the first through the  $n+1$ st tokens are not and there is a line break between the  $n$ th tokens and the  $n+1$ st tokens, then the parser tries to parse the program again after inserting a VirtualSemicolon token between the  $n$ th and the  $n+1$ st tokens]
- 5

Identifier

[see Ecma-262 section 7.6]
- 6

StringLiteral

[see Ecma-262 section 7.8.4]
- 7

[see Line continuations spec: [http://wiki.ecmascript.org/doku.php?id=features\\_specs:line\\_continuation\\_in\\_strings](http://wiki.ecmascript.org/doku.php?id=features_specs:line_continuation_in_strings)]
- 8

DoubleLiteral

[see Ecma-262 section 7.8.3]
- 9

DecimalLiteral

[Literals that denote decimal objects can be expressed as numeric literals (see E262 sec 7.8.3) with a suffix "m": 10m; 12.48m; 1.5e-7m. When these literals are evaluated they yield new instances of decimal objects]

## RegExplInitialiser

- 10 [see Ecma-262 section 7.8.5]  
11 [see Extend RegExp: [http://developer.mozilla.org/es4/proposals/extend\\_regexp.html](http://developer.mozilla.org/es4/proposals/extend_regexp.html)]  
12 [see Line continuations spec: [http://wiki.ecmascript.org/doku.php?id=features\\_specs:line\\_continuation\\_in\\_strings](http://wiki.ecmascript.org/doku.php?id=features_specs:line_continuation_in_strings)]

## PROGRAM STRUCTURE

### EXPRESSIONS

$\alpha = \{ \text{allowColon}, \text{noColon} \}$

$\beta = \{ \text{allowIn}, \text{noIn} \}$

Identifier

- 1 3 **Identifier**  
2 3 **ContextuallyReservedIdentifier**

PropertyIdentifier

- 3 3 Identifier  
4 4 **ReservedIdentifier**

NameExpression

- 5 3 Identifier  
6 4 NamespaceExpression :: PropertyIdentifier

NamespaceExpression

- 7 4 NameExpression  
8 4 **StringLiteral**

ParenExpression

- 9 3 ( CommaExpression<sup>allowColon, allowIn</sup> )

FunctionExpression <sup>$\alpha, \beta$</sup>

- 10 3 **function** PropertyIdentifier FunctionSignature FunctionExpressionBody <sup>$\alpha, \beta$</sup>   
11 3 **function** FunctionSignature FunctionExpressionBody <sup>$\alpha, \beta$</sup>

FunctionExpressionBody <sup>$\alpha, \beta$</sup>

- 12 3 { Directives<sup>local</sup> }  
13 4 CommaExpression <sup>$\alpha, \beta$</sup>

ObjectInitialiser<sup>noColon</sup>

- 14 3 InitialiserAttribute { FieldList }

ObjectInitialiser<sup>allowColon</sup>

- 15 3 InitialiserAttribute { FieldList }  
16 4 InitialiserAttribute { FieldList } : TypeExpression

FieldList

- 17 3 «empty»  
18 3 Field  
19 3 Field , FieldList

Field

- 20 3 InitialiserAttribute FieldName : AssignmentExpression<sup>allowColon, allowIn</sup>

```

21 4 InitialiserAttribute get FieldName GetterSignature FunctionExpressionBodyallowColon, allowIn
22 4 InitialiserAttribute set FieldName SetterSignature FunctionExpressionBodyallowColon, allowIn
23 3 __proto__ : AssignmentExpressionallowColon, allowIn

    InitialiserAttribute
24 3 «empty»
25 4 const
26 4 var

    FieldName
27 3 NameExpression
28 3 StringLiteral
29 3 NumberLiteral
30 4 [lookahead !__proto__] ReservedIdentifier

    ArrayInitialisernoColon
31 3 InitialiserAttribute [ ArrayElements ]

    ArrayInitialiserallowColon
32 3 InitialiserAttribute [ ArrayElements ]
33 4 InitialiserAttribute [ ArrayElements ] : TypeExpression

    ArrayElements
34 3 ArrayElementList
35 4 ArrayComprehension

    ArrayElementList
36 3 «empty»
37 3 AssignmentExpressionallowColon, allowIn
38 3 SpreadExpression
39 3 , ArrayElementList
40 3 AssignmentExpressionallowColon, allowIn , ArrayElementList

    SpreadExpression
41 4 ... AssignmentExpressionallowColon, allowIn

    ArrayComprehension
42 4 AssignmentExpressionallowColon, allowIn ComprehensionExpression

    ComprehensionExpression
43 4 for ( TypedPatternnoIn in CommaExpressionallowColon, allowIn ) ComprehensionClause
44 4 for each ( TypedPatternnoIn in CommaExpressionallowColon, allowIn ) ComprehensionClause
45 4 let ( LetBindingList ) ComprehensionClause
46 4 if ParenExpression ComprehensionClause

    ComprehensionClause
47 4 «empty»
48 4 ComprehensionExpression

    PrimaryExpressionno, B
49 3 null
50 3 true
51 3 false

```

52 3   **DoubleLiteral**  
 53 4   **DecimalLiteral**  
 54 3   **StringLiteral**  
 55 3   **RegExpInitialiser**  
 56 3   ArrayInitialiser<sup>α</sup>  
 57 3   ObjectInitialiser<sup>α</sup>  
 58 3   FunctionExpression<sup>α, β</sup>  
 59 3   ThisExpression  
 60 4   LetExpression<sup>α, β</sup>  
 61 3   ParenExpression  
 62 3   NameExpression

ThisExpression  
 63 3   **this**  
 64 4   **this** [no line break] **function**  
 65 4   **this** [no line break] **generator**

LetExpression<sup>α, β</sup>  
 66 4   **let** ( LetBindingList ) CommaExpression<sup>α, β</sup>

LetBindingList  
 67 4   «empty»  
 68 4   VariableBindingList<sup>allowIn</sup>

Arguments  
 69 3   ( )  
 70 3   ( SpreadExpression )  
 71 3   ( ArgumentList )  
 72 3   ( ArgumentList , SpreadExpression )

ArgumentList  
 73 3   AssignmentExpression<sup>allowColon, allowIn</sup>  
 74 3   ArgumentList , AssignmentExpression<sup>allowColon, allowIn</sup>

PropertyOperator  
 75 4   . **ReservedIdentifier**  
 76 3   . NameExpression  
 77 3   Brackets  
 78 4   TypeApplication

Brackets  
 79 3   [ CommaExpression<sup>noColon, allowIn</sup> ]  
 80 4   [ SliceExpression ]

SliceExpression  
 81 4   OptionalExpression<sup>noColon</sup> : OptionalExpression<sup>noColon</sup>  
 82 4   OptionalExpression<sup>noColon</sup> : OptionalExpression<sup>noColon</sup> : OptionalExpression<sup>allowColon</sup>  
 83 4   :: OptionalExpression<sup>allowColon</sup>  
 84 4   OptionalExpression<sup>noColon</sup> ::

OptionalExpression<sup>α</sup>  
 85 4   «empty»  
 86 4   CommaExpression<sup>α, allowIn</sup>

```

TypeApplication
87 4  .< TypeExpressionList >

MemberExpressionα,β
88 3  PrimaryExpressionα,β
89 3  new MemberExpressionα,β Arguments
90 4  SuperExpression PropertyOperator
91 3  MemberExpressionα,β PropertyOperator

SuperExpression
92 4  super
93 4  super ParenExpression

CallExpressionα,β
94 3  MemberExpressionα,β Arguments
95 3  CallExpressionα,β Arguments
96 3  CallExpressionα,β PropertyOperator

NewExpressionα,β
97 3  MemberExpressionα,β
98 3  new NewExpressionα,β

LeftHandSideExpressionα,β
99 3  NewExpressionα,β
100 3  CallExpressionα,β

PostfixExpressionα,β
101 3  LeftHandSideExpressionα,β
102 3  LeftHandSideExpressionα,β [no line break] ++
103 3  LeftHandSideExpressionα,β [no line break] --

UnaryExpressionα,β
104 3  PostfixExpressionα,β
105 3  delete PostfixExpressionα,β
106 3  void UnaryExpressionα,β
107 3  typeof UnaryExpressionα,β
108 3  ++ PostfixExpressionα,β
109 3  -- PostfixExpressionα,β
110 3  + UnaryExpressionα,β
111 3  - UnaryExpressionα,β
112 3  ~ UnaryExpressionα,β
113 3  ! UnaryExpressionα,β
114 4  type TypeExpression

MultiplicativeExpressionα,β
115 3  UnaryExpressionα,β
116 3  MultiplicativeExpressionα,β * UnaryExpressionα,β
117 3  MultiplicativeExpressionα,β / UnaryExpressionα,β
118 3  MultiplicativeExpressionα,β % UnaryExpressionα,β

AdditiveExpressionα,β
119 3  MultiplicativeExpressionα,β

```

120 3 AdditiveExpression<sup>α,β</sup> **+** MultiplicativeExpression<sup>α,β</sup>  
 121 3 AdditiveExpression<sup>α,β</sup> **-** MultiplicativeExpression<sup>α,β</sup>  
  
 ShiftExpression<sup>α,β</sup>  
 122 3 AdditiveExpression<sup>α,β</sup>  
 123 3 ShiftExpression<sup>α,β</sup> **<<** AdditiveExpression<sup>α,β</sup>  
 124 3 ShiftExpression<sup>α,β</sup> **>>** AdditiveExpression<sup>α,β</sup>  
 125 3 ShiftExpression<sup>α,β</sup> **>>>** AdditiveExpression<sup>α,β</sup>  
  
 RelationalExpression<sup>α,β</sup>  
 126 3 ShiftExpression<sup>α,β</sup>  
 127 3 RelationalExpression<sup>α,β</sup> **<** ShiftExpression<sup>α,β</sup>  
 128 3 RelationalExpression<sup>α,β</sup> **>** ShiftExpression<sup>α,β</sup>  
 129 3 RelationalExpression<sup>α,β</sup> **<=** ShiftExpression<sup>α,β</sup>  
 130 3 RelationalExpression<sup>α,β</sup> **>=** ShiftExpression<sup>α,β</sup>  
 131 3 RelationalExpression<sup>α,β</sup> [**β** == allowIn] **in** ShiftExpression<sup>α,β</sup>  
 132 3 RelationalExpression<sup>α,β</sup> **instanceof** ShiftExpression<sup>α,β</sup>  
 133 4 RelationalExpression<sup>α,β</sup> **cast** TypeExpression  
 134 4 RelationalExpression<sup>α,β</sup> **is** TypeExpression  
 135 4 RelationalExpression<sup>α,β</sup> **like** TypeExpression  
  
 EqualityExpression<sup>α,β</sup>  
 136 3 RelationalExpression<sup>α,β</sup>  
 137 3 EqualityExpression<sup>α,β</sup> **==** RelationalExpression<sup>α,β</sup>  
 138 3 EqualityExpression<sup>α,β</sup> **!=** RelationalExpression<sup>α,β</sup>  
 139 3 EqualityExpression<sup>α,β</sup> **===** RelationalExpression<sup>α,β</sup>  
 140 3 EqualityExpression<sup>α,β</sup> **!==** RelationalExpression<sup>α,β</sup>  
  
 BitwiseAndExpression<sup>α,β</sup>  
 141 3 EqualityExpression<sup>α,β</sup>  
 142 3 BitwiseAndExpression<sup>α,β</sup> **&** EqualityExpression<sup>α,β</sup>  
  
 BitwiseXorExpression<sup>α,β</sup>  
 143 3 BitwiseAndExpression<sup>α,β</sup>  
 144 3 BitwiseXorExpression<sup>α,β</sup> **^** BitwiseAndExpression<sup>α,β</sup>  
  
 BitwiseOrExpression<sup>α,β</sup>  
 145 3 BitwiseXorExpression<sup>α,β</sup>  
 146 3 BitwiseOrExpression<sup>α,β</sup> **|** BitwiseXorExpression<sup>α,β</sup>  
  
 LogicalAndExpression<sup>α,β</sup>  
 147 3 BitwiseOrExpression<sup>α,β</sup>  
 148 3 LogicalAndExpression<sup>α,β</sup> **&&** BitwiseOrExpression<sup>α,β</sup>  
  
 LogicalOrExpression<sup>α,β</sup>  
 149 3 LogicalAndExpression<sup>α,β</sup>  
 150 3 LogicalOrExpression<sup>α,β</sup> **||** LogicalAndExpression<sup>α,β</sup>  
  
 ConditionalExpression<sup>α,β</sup>  
 151 4 YieldExpression<sup>α,β</sup>  
 152 3 LogicalOrExpression<sup>α,β</sup>  
 153 3 LogicalOrExpression<sup>α,β</sup> **?** AssignmentExpression<sup>noColon,β</sup>  
 154 : AssignmentExpression<sup>α,β</sup>

NonAssignmentExpression<sup>α, β</sup>

155 4 YieldExpression<sup>α, β</sup>

156 3 LogicalOrExpression<sup>α, β</sup>

157 3 LogicalOrExpression<sup>α, β</sup> ? NonAssignmentExpression<sup>noColon, β</sup>

158 3 : NonAssignmentExpression<sup>α, β</sup>

YieldExpression<sup>α, β</sup>

159 4 **yield**

160 4 **yield** [no line break] AssignmentExpression<sup>α, β</sup>

AssignmentExpression<sup>α, β</sup>

161 3 ConditionalExpression<sup>α, β</sup>

162 3 Pattern<sup>α, β, allowExpr</sup> = AssignmentExpression<sup>α, β</sup>

163 3 SimplePattern<sup>α, β, allowExpr</sup> CompoundAssignmentOperator AssignmentExpression<sup>α, β</sup>

CompoundAssignmentOperator

164 3 **\*=**

165 3 **/=**

166 3 **%=**

167 3 **+=**

168 3 **-=**

169 3 **<<=**

170 3 **>>=**

171 3 **>>>=**

172 3 **&=**

173 3 **^=**

174 3 **|=**

175 3 **&&=**

176 3 **||=**

CommaExpression<sup>α, β</sup>

177 3 AssignmentExpression<sup>α, β</sup>

178 3 CommaExpression<sup>α, β</sup> , AssignmentExpression<sup>α, β</sup>

## PATTERNS

$\gamma = \{ \text{allowExpr}, \text{noExpr} \}$

Pattern<sup>α, β, γ</sup>

179 3 SimplePattern<sup>α, β, γ</sup>

180 4 ObjectPattern<sup>α, β, γ</sup>

181 4 ArrayPattern<sup>γ</sup>

SimplePattern<sup>α, β, noExpr</sup>

182 3 Identifier

SimplePattern<sup>α, β, allowExpr</sup>

183 3 LeftHandSideExpression<sup>α, β</sup>

ObjectPattern<sup>γ</sup>

184 4 { FieldListPattern<sup>γ</sup> }

```

FieldListPatternγ
185 4  «empty»
186 4  FieldPatternγ
187 4  FieldListPatternγ ,
188 4  FieldListPatternγ , FieldPatternγ

FieldPatternγ
189 4  FieldName
190 4  FieldName : PatternallowColon, allowIn, γ

ArrayPatternγ
191 4  [ ElementListPatternγ ]

ElementListPatternγ
192 4  «empty»
193 4  ElementPatternγ
194 4  ... SimplePatternallowColon, allowIn, γ
195 4  , ElementListPatternγ
196 4  ElementPatternγ , ElementListPatternγ

ElementPatternγ
197 4  PatternallowColon, allowIn, γ

TypedIdentifier
198 3  Identifier
199 4  Identifier : TypeExpression

TypedPatternβ
200 3  PatternnoColon, β, noExpr
201 4  PatternnoColon, β, noExpr : TypeExpression

LikenedPatternβ
202 4  PatternnoColon, β, noExpr like TypeExpression

```

## TYPE EXPRESSIONS

```

TypeExpression
203 4  BasicTypeExpression
204 4  ? BasicTypeExpression
205 4  ! BasicTypeExpression

BasicTypeExpression
206 4  *
207 4  null
208 4  undefined
209 4  TypeName
210 4  FunctionType
211 4  UnionType
212 4  RecordType
213 4  ArrayType

TypeName
214 4  NameExpression

```



```

215 4   NameExpression TypeApplication

      FunctionType
216 4   function FunctionSignatureType

      FunctionSignatureType
217 4   TypeParameters ( ) ResultType
218 4   TypeParameters ( ParametersType ) ResultType
219 4   TypeParameters ( this : TypeName ) ResultType
220 4   TypeParameters ( this : TypeName , ParametersType ) ResultType

      ParametersType
221 4   RestParameterType
222 4   NonRestParametersType
223 4   NonRestParametersType , RestParameterType

      NonRestParametersType
224 4   ParameterType , NonRestParametersType
225 4   ParameterType
226 4   OptionalParametersType

      OptionalParametersType
227 4   OptionalParameterType
228 4   OptionalParameterType , OptionalParametersType

      OptionalParameterType
229 4   ParameterType =

      ParameterType
230 4   TypeExpression
231 4   Identifier : TypeExpression

      RestParameterType
232 4   ...
233 4   ... Identifier

      UnionType
234 4   ( TypeUnionList )

      TypeUnionList
235 4   «empty»
236 4   NonemptyTypeUnionList

      NonemptyTypeUnionList
237 4   TypeExpression
238 4   TypeExpression | NonemptyTypeUnionList

      RecordType
239 4   { FieldTypeList }

      FieldTypeList
240 4   «empty»
241 4   FieldType

```

```

242 4   FieldType , FieldTypeList

      FieldType
243 4   FieldType
244 4   FieldType : TypeExpression

      ArrayType
245 4   [ ElementTypeList ]

      ElementTypeList
246 4   «empty»
247 4   TypeExpression
248 4   ... TypeExpression
249 4   , ElementTypeList
250 4   TypeExpression , ElementTypeList

      TypeExpressionList
251 4   TypeExpression
252 4   TypeExpressionList , TypeExpression

```

## STATEMENTS

$\tau = \{ \text{constructor, class, global, interface, local, statement} \}$   
 $\omega = \{ \text{abbrev, noShortIf, full} \}$

```

      Statementω
253 3   BlockStatement
254 3   BreakStatement Semicolonω
255 3   ContinueStatement Semicolonω
256 3   DoWhileStatement Semicolonω
257 3   EmptyStatement
258 3   ExpressionStatement Semicolonω
259 3   ForStatementω
260 3   IfStatementω
261 3   LabeledStatementω
262 4   LetBlockStatement
263 3   ReturnStatement Semicolonω
264 3   SwitchStatement
265 4   SwitchTypeStatement
266 3   ThrowStatement Semicolonω
267 3   TryStatement
268 3   WhileStatementω
269 3   WithStatementω

```

```

      Substatementω
270 3   Statementω
271 3   VariableDefinitionnoIn, statement

```

```

      Semicolonabbrev
272 3   ;
273 3   VirtualSemicolon
274 3   «empty»

```

```

SemicolonnoShortIf
275 3 ;
276 3 VirtualSemicolon
277 3 «empty»

Semicolonfull
278 3 ;
279 3 VirtualSemicolon

EmptyStatement
280 3 ;

ExpressionStatement
281 3 [lookahead !{ const, function, let, var }] CommaExpressionallowColon, allowIn

BlockStatement
282 3 { Directiveslocal }

LabeledStatementno
283 3 Identifier : Substatementno

LetBlockStatement
284 4 let ( LetBindingList ) { Directiveslocal }

IfStatementabbrev
285 3 if ParenExpression Substatementabbrev
286 3 if ParenExpression SubstatementnoShortIf else Substatementabbrev

IfStatementfull
287 3 if ParenExpression Substatementfull
288 3 if ParenExpression SubstatementnoShortIf else Substatementfull

IfStatementnoShortIf
289 3 if ParenExpression SubstatementnoShortIf else SubstatementnoShortIf

WithStatementno
290 3 with ParenExpression Substatementno

SwitchStatement
291 3 switch ParenExpression { CaseElements }

3 CaseElements
292 3 CaseClausesfull DefaultClausefull CaseClausesabbrev
293 3 CaseClausesfull DefaultClauseabbrev
294 3 CaseClausesabbrev

3 CaseClausesno
295 3 «empty»
296 3 CaseClausesfull CaseClauseno

3 CaseClauseno
297 3 case CommaExpressionallowColon, allowIn : Directiveslocal, no

```

3 DefaultClause<sup>Ⓢ</sup>

298 3 **default** : Directives<sup>local, Ⓢ</sup>

SwitchTypeStatement

299 4 **switch type** ParenExpression { TypeCaseElements }

TypeCaseElements

300 4 TypeCaseElement

301 4 TypeCaseElements TypeCaseElement

TypeCaseElement

302 4 **case** ( TypedPattern<sup>allowColon, allowIn</sup> ) { Directives<sup>local</sup> }

DoWhileStatement

303 3 **do** Substatement<sup>Ⓢabbrev</sup> **while** ParenExpression

WhileStatement<sup>Ⓢ</sup>

304 3 **while** ParenExpression Substatement<sup>Ⓢ</sup>

ForStatement<sup>Ⓢ</sup>

305 3 **for** ( ForInitialiser ; OptionalExpression<sup>allowColon</sup> ; OptionalExpression<sup>allowColon</sup> ) Substatement<sup>Ⓢ</sup>

306 3 **for** ( ForInBinding **in** CommaExpression<sup>allowColon, allowIn</sup> ) Substatement<sup>Ⓢ</sup>

307 4 **for each** ( ForInBinding **in** CommaExpression<sup>allowColon, allowIn</sup> ) Substatement<sup>Ⓢ</sup>

ForInitialiser

308 3 «empty»

309 3 CommaExpression<sup>allowColon, noIn</sup>

310 3 VariableDefinition<sup>noIn, τ</sup>

ForInBinding

311 3 Pattern<sup>allowColon, noIn, allowExpr</sup>

312 3 VariableDefinitionKind<sup>local</sup> VariableBinding<sup>noIn</sup>

ContinueStatement

313 3 **continue**

314 3 **continue** [no line break] Identifier

BreakStatement

315 3 **break**

316 3 **break** [no line break] Identifier

ReturnStatement

317 3 **return**

318 3 **return** [no line break] CommaExpression<sup>allowColon, allowIn</sup>

ThrowStatement

319 3 **throw** CommaExpression<sup>allowColon, allowIn</sup>

TryStatement

320 3 **try** { Directives<sup>local</sup> } CatchClauses

321 3 **try** { Directives<sup>local</sup> } CatchClauses **finally** { Directives<sup>local</sup> }

322 3 **try** { Directives<sup>local</sup> } **finally** { Directives<sup>local</sup> }

```

    CatchClauses
323 3   CatchClause
324 3   CatchClauses CatchClause

    CatchClause
325 3   catch ( Parameter ) { Directiveslocal }

    SuperStatement
326 4   super ( Arguments )

DIRECTIVES

    Directivesτ
327 3   «empty»
328 3   DirectivesPrefixτ Directiveτ, abbrev

    DirectivesPrefixτ
329 3   «empty»
330 3   DirectivesPrefixτ Directiveτ, full

    Directiveclass, ω
331 4   Pragmaclass
332 4   static [no line break] { Directiveslocal }
333 4   AnnotatableDirectiveclass, ω

    Directiveinterface, ω
334 4   Pragmainterface
335 4   AnnotatableDirectiveinterface, ω

    Directiveconstructor, ω
336 4   Pragmalocal
337 4   SuperStatement Semicolonω
338 4   Statementω
339 4   AnnotatableDirectivelocal, ω

    Directiveτ, ω
340 4   Pragmaτ
341 3   Statementω
342 3   AnnotatableDirectiveτ, ω

    AnnotatableDirectiveglobal, ω
343 4   Attribute [no line break] AnnotatableDirectiveglobal, ω
344 3   VariableDefinitionallowIn, global Semicolonω
345 3   FunctionDefinitionglobal, ω
346 4   NamespaceDefinition Semicolonω
347 4   ClassDeclaration Semicolonω
348 4   ClassDefinition
349 4   InterfaceDeclaration Semicolonω
350 4   InterfaceDefinition
351 4   TypeDeclaration Semicolonω
352 4   TypeDefinition Semicolonω

    AnnotatableDirectiveclass, ω

```

353 4   Attribute [no line break] AnnotatableDirective<sup>class, ω</sup>  
354 3   VariableDefinition<sup>allowIn, class</sup> Semicolon<sup>ω</sup>  
355 3   FunctionDefinition<sup>class, ω</sup>  
356 4   NamespaceDefinition Semicolon<sup>ω</sup>  
357 4   TypeDefinition Semicolon<sup>ω</sup>

          AnnotatableDirective<sup>interface, ω</sup>  
358 4   Attribute [no line break] AnnotatableDirective<sup>interface, ω</sup>  
359 4   FunctionDeclaration Semicolon<sup>ω</sup>

          AnnotatableDirective<sup>local, ω</sup>  
360 3   VariableDefinition<sup>allowIn, local</sup> Semicolon<sup>ω</sup>  
361 3   FunctionDefinition<sup>local, ω</sup>

      Attribute  
362 4    NamespaceExpression  
363       **dynamic**  
364 4    **final**  
365 4    **override**  
366 4    **\_\_proto\_\_**  
367 4    **static**

**DEFINITIONS**

      VariableDefinition<sup>β, τ</sup>  
368 3    VariableDefinitionKind<sup>τ</sup> VariableBindingList<sup>β</sup>

      VariableDefinitionKind<sup>statement</sup>  
369 3    **var**

      VariableDefinitionKind<sup>τ</sup>  
370 4    **const**  
371 4    **let**  
372 3    **var**

      VariableBindingList<sup>β</sup>  
373 3    VariableBinding<sup>β</sup>  
374 3    VariableBindingList<sup>β</sup> , VariableBinding<sup>β</sup>

      VariableBinding<sup>β</sup>  
375 3    TypedIdentifier  
376 3    TypedPattern<sup>β</sup> VariableInitialisation<sup>β</sup>

      VariableInitialisation<sup>β</sup>  
377 3    **=** AssignmentExpression<sup>allowColon, β</sup>

      FunctionDeclaration  
378 4    **function** PropertyIdentifier FunctionSignatureType  
379 4    **function get** PropertyIdentifier GetterSignature  
380 4    **function set** PropertyIdentifier SetterSignature

      FunctionDefinition<sup>class, ω</sup>  
381 4    **function** Identifier [Identifier == outer classname] ConstructorSignature { Directives<sup>constructor</sup> }

```

382 4  function PropertyIdentifier FunctionSignature FunctionBodyallowIn, ω
383 4  function get PropertyIdentifier GetterSignature FunctionBodyallowIn, ω
384 4  function set PropertyIdentifier SetterSignature FunctionBodyallowIn, ω
385 4  native FunctionDeclaration

      FunctionDefinitionlocal, ω
386 4  const function PropertyIdentifier FunctionSignature FunctionBodyallowIn, ω
387 4  function PropertyIdentifier FunctionSignature FunctionBodyallowIn, ω

      FunctionDefinitionτ, ω
388 4  const function PropertyIdentifier FunctionSignature FunctionBodyallowIn, ω
389 4  function PropertyIdentifier FunctionSignature FunctionBodyallowIn, ω
390 4  function get PropertyIdentifier GetterSignature FunctionBodyallowIn, ω
391 4  function set PropertyIdentifier SetterSignature FunctionBodyallowIn, ω
392 4  native FunctionDeclaration

      FunctionSignature
393 3  TypeParameters ( ) ResultTypeOrLike
394 3  TypeParameters ( Parameters ) ResultTypeOrLike
395 4  TypeParameters ( this : TypeName ) ResultTypeOrLike
396 4  TypeParameters ( this : TypeName , Parameters ) ResultTypeOrLike

      GetterSignature
397 4  ( ) ResultTypeOrLike

      SetterSignature
398 4  ( Parameter ) ResultTypeVoid

      FunctionBodyα, β, ω
399 3  { Directiveslocal }
400 4  CommaExpressionα, β Semicolonω

      TypeParameters
401 3  «empty»
402 4  .< TypeParameterList >

      TypeParameterList
403 4  Identifier
404 4  Identifier , TypeParameterList

      Parameters
405 4  RestParameter
406 3  NonRestParameters
407 4  NonRestParameters , RestParameter

      NonRestParameters
408 3  Parameter , NonRestParameters
409 3  Parameter
410 3  OptionalParameters

      OptionalParameters
411 4  OptionalParameter
412 4  OptionalParameter , OptionalParameters

```

OptionalParameter  
413 4 Parameter = NonAssignmentExpression<sup>allowIn</sup>

Parameter  
414 3 ParameterAttribute TypedPattern<sup>allowIn</sup>  
415 3 ParameterAttribute LikenedPattern<sup>allowIn</sup>

ParameterAttribute  
416 3 «empty»  
417 4 **const**

RestParameter  
418 4 ...  
419 4 ... Identifier

ResultTypeOrLike  
420 4 ResultType  
421 4 **like** TypeExpression

ResultType  
422 4 «empty»  
423 4 : **void**  
424 4 : TypeExpression

ResultTypeVoid  
425 4 «empty»  
426 4 : **void**

ConstructorSignature  
427 4 ( Parameters )  
428 4 ( Parameters ) : ConstructorInitialiser

ConstructorInitialiser  
429 4 SettingList  
430 4 SettingList , SuperInitialiser  
431 4 SuperInitialiser

SettingList  
432 4 Setting  
433 4 SettingList , Setting

Setting  
434 4 Pattern<sup>allowIn, allowExpr</sup> VariableInitialisation<sup>allowIn</sup>

SuperInitialiser  
435 4 **super** Arguments

ClassDeclaration  
436 **class** Identifier TypeSignature

ClassDefinition  
437 4 **class** Identifier TypeSignature ClassInheritance ClassBody



```

TypeSignature
438 4  TypeParameters
439 4  TypeParameters !

ClassInheritance
440 4  «empty»
441 4  extends TypeName
442 4  implements TypeNameList
443 4  extends TypeName implements TypeNameList

TypeNameList
444 4  TypeName
445 4  TypeNameList , TypeName

ClassBody
446 4  { Directivesclass }

InterfaceDeclaration
447 4  interface Identifier TypeSignature

InterfaceDefinition
448 4  interface Identifier TypeSignature InterfaceInheritance InterfaceBody

InterfaceInheritance
449 4  «empty»
450 4  extends TypeNameList

InterfaceBody
451 4  { Directivesinterface }

TypeDeclaration
452 4  type Identifier TypeSignature

TypeDefinition
453 4  type Identifier TypeSignature TypeInitialisation

TypeInitialisation
454 4  = TypeExpression

NamespaceDefinition
455 4  namespace Identifier NamespaceInitialisation

NamespaceInitialisation
456 4  «empty»
457 4  = NamespaceExpression

PRAGMAS

Pragmar
458 4  UsePragmar Semicolonfull

UsePragmar

```

```
459 4  use Pragmaltemsτ

      Pragmaltemsτ
460 4  Pragmaltemτ
461 4  Pragmaltemsτ , Pragmaltemτ

      Pragmaltemlocal
462 4  namespace NamespaceExpression
463 4  strict

      Pragmaltemglobal
464 4  default namespace NamespaceExpression
465 4  namespace NamespaceExpression
466 4  standard
467 4  strict

      Pragmaltemτ
468 4  default namespace NamespaceExpression
469 4  namespace NamespaceExpression
470 4  strict
```

**PROGRAMS**

```
      Program
471 3  Directivesglobal
```

## Revision History:

**10-May-2008:** Add alpha to OptionalExpression (79-82, 83-84, 307); Replace inadvertently erased definition of LetBindingList; Replace ParenExpression with LetBindingList in ComprehensionExpression (45); Remove hack to handle >> and >>> in < expressions (86, 87); Move lookahead restriction on \_\_proto\_\_ from NameExpression to ReservedIdentifier in FieldName (27, 30); Change allowColon to allowIn in TypedPattern and LikenedPattern (202-205); Add explicit syntax for native functions to FunctionDefinition (386-389, 392-395); Remove TypeParameter from GetterSignature and SetterSignature (400, 401); Change FunctionSignature to GetterSignature and SetterSignature in FunctionDefinition (388, 389, 394, 395); Insert comma in ConstructorInitialiser (433); Restrict use of 'use standard' to global code (470); Add use of EmptyStatement to Statement (255-270); Remove use of EmptyStatement from Substatement and Directive (272, 339, 344); Move unary 'type' expression to UnaryExpression and erase definition and uses of UnaryTypeExpression (104-113, 150, 155, 160); Remove tau parameter from Statement (255-270, 272, 341, 345)

**05-May-2008:** Remove paren expression qualifier from PrimaryName (7); Rename NamespaceName to NamespaceExpression (6, 8, 9, 366, 370, 376, 466, 471, 474, 475); Remove Brackets (); Rename BracketsOrSlice to Brackets (); Rename PrimaryName to NameExpression (); Replace TypeName with TypeExpression in initialiser annotations (17, 35); Remove structural type annotation on array and object initialisers (18, 36); Add InitialiserAttribute to getter and setter syntax in object initialisers (24, 25); Inline ArrayElement (40, 43, 46); Replace use of NonemptyLetBindingList with VariableBindingList (72); Erase definition of NonemptyLetBindingList (73, 74); Refactor FunctionTypeSignature and FunctionSignature to allow rest after this parameter (230-233, 400-402, 411-415); Replace occurrences of Block with { Directives } (292, 294, 312, 330, 331, 332, 335, 455, 460); Remove definition of Block (478); Erase errant ':' (404); Remove unused ResultTypeBoolean (434-435); Add SuperStatement and Directive for constructor contexts; Allow Pragma wherever Directive is allowed (339, 341-346); Consolidate Attribute non-terminals (347, 357, 362, 366-376)

**29-Apr-2008:** Define NamespaceName; Use NamespaceName from 'use namespace', 'use default namespace', NamespaceInitialisation, qualifier expressions and Attribute (6, 359, 363, 369, 456, 462, 465, 466); Define ClassDeclaration, InterfaceDeclaration and TypeDeclaration and allow them in global code (343-349); Moved 'const', 'dynamic', 'final', 'interface', 'let', 'namespace', 'native', 'override', 'prototype', 'static', 'use', and 'yield' from ContextuallyReservedIdentifier to ReservedIdentifier (lexical: 1, 2); Rename TypeReference to TypeName and TypeReferenceList to TypeNameList (223, 224, 445, 446); Replace all uses of TypeReference, TypeReferenceList, and PrimaryName that are type names with TypeName (16, 34, 218, 227, 228, 394, 395, 442-446, 450); Rename 'prototype' to '\_\_proto\_\_' in Attribute (367); Move '\_\_proto\_\_' from ContextuallyReservedIdentifier to ReservedIdentifier (lexical: 1, 2); Remove [look ahead...] conditions in Attribute (359, 363); Add LetBlockStatement to Statement (261-275)

**26-Apr-2008:** Remove ambiguous production 'ParenExpression :: QualifiedNameIdentifier' in PropertyOperator (82); Remove stale use of PackageDefinition in AnnotatableDirective (349); Remove ParameterType without trailing '=' from OptionalParameterType (237); Refactored Parameters and ParametersType to allow a rest parameter as the only parameter (340, 407); Remove namespace and type definitions from local blocks (359, 360); Add Directive for class and interface blocks; Add DecimalLiteral to PrimaryExpression (55); Add lookahead condition to disambiguate PrimaryName from explicit identifiers in Attributes (361, 365); Replace FunctionName with Identifier in FunctionDeclaration (384); Add productions for getters and setters in FunctionDeclaration (384); Remove 'import' from ContextuallyReservedIdentifiers (2, lexical); Remove restriction disallowing 'let' in classes (374, 375); Allow ReservedIdentifiers as function identifiers (11, 384-394); Disallow 'use default namespace' in local blocks (336, 459-466); Remove the use of StringLiteral and NumberLiteral in QualifiedNameIdentifier and rename to PropertyIdentifier (5, 6); Move ! in TypeSignature from prefix to postfix position (441)

**19-Apr-2008:** Remove Qualifier non-terminal (3, 4); Remove PrimaryName that begins with Qualifier (4); Remove definition of ReservedNamespace (5-8); Replace uses of NamespaceAttribute with PrimaryName (378, 382, 388, ); Remove definition of NamespaceAttribute (389-396); Add [no line break] to ReturnStatement (342); Move definition of gamma parameters to Patterns section; Add 'meta', 'reflect', 'intrinsic', 'iterator' and \_\_proto\_\_ to ContextuallyReservedIdentifiers (3, 4: lexical); Remove duplicate productions in RelationalExpression by adding an inline condition for beta == allowIn (150-158, 145); Allow Pragma anywhere in DirectivesPrefix (353); Remove definition of Pragmas (484, 485); Remove lingering use of ImportPragma in Pragma (487)

**18-Apr-2008:** Remove TypeParameter from ConstructorSignature (452, 453); Remove Brackets in QualifiedNameIdentifier (13); Change argument to Block in BlockStatement to 'local' (304); Removed lingering uses of 'external' from NamespaceAttributes (388, 394); Remove lingering E4X punctuators </ and /> from (6, lexical); Change let and function expression forms to use CommaExpression instead of AssignmentExpression (22, 76, 423); Add productions for handling >> and >>> in TypeApplication (101); Add productions for handling :: in SliceExpression (98); Disallow 'let' in class bodies (398)

**17-Apr-2008:** Rename ElementComprehension to ArrayComprehension; Allow empty body of 'let' clause in ArrayComprehension; Add 'standard' as a pragma; Fix obligatory ',' bug in ArrayType; Allow only SimplePattern in RestParameter; Remove PackageDefinition; Remove ImportPragma; Remove 'external' from ReservedIdentifier and ReservedNamespace; Add 'Identifier : TypeExpression' to ParameterType; Replace TypeExpression with Identifier in RestParameterType; Removed 'meta:.' productions from ObjectInitialiser; Remove ContextuallyReservedIdentifiers 'package', and 'xml'; (Re-)add ContextuallyReservedIdentifier 'standard'; Replace uses of QualifiedName with PrimaryName; Remove QualifiedName;

**10-Apr-2008:** Removed reserved E4X syntax; Rename and update object and array initialisers to match latest proposals; Rename SplatExpression to SpreadExpression; Add signatures for getters and setters; Add void and boolean result types; Move 'internal', 'private', 'protected', 'public' from ReservedIdentifier to ContextuallyReservedIdentifier; Rename various "Literal" non-terminal to "Initialiser" with corresponding changes to their constituents; Change argument to CommaExpression in BracketOrSlice from allowColon to noColon; Allow FieldType with ': TypeExpression' elided; Remove getters and setters from local blocks; Change signature of FunctionDeclaration to FunctionSignatureType; Include nested let, if and for-in expressions in ElementComprehension; Allow 'const' attribute on parameters; Require optional parameters to follow obligatory ones; Replace SimplePattern in TypedIdentifier with Identifier; Refactor CaseElements; Add 'const' and 'var' to the lookahead set of ExpressionStatement

**09-Apr-2008:** Remove description of triple quoted strings; Rename LikedPattern to LikenedPattern; Allow trailing comma in RecordType and ObjectPattern; Add [no line break] to ThisExpression; Add reference to "line continuations" spec in lexical section; Limit syntax of annotations on object and array literals; Replace PrimaryName... in TypeExpression with TypeReference; Refactor class Block to only allow a static block statements; Added description of source text handling; Allow VariableDefinition in Substatement

**03-Apr-2008:** Remove reserved identifiers 'wrap' and 'has'; Replace use of PropertyName with PrimaryName in PropertyOperator; Remove definition of PropertyName; Remove 'enum' from ReservedIdentifiers; Move 'extends' from ReservedIdentifiers to ContextuallyReservedIdentifiers; Add FieldKind to getters and setter in LiteralField; Remove omega from VariableDefinition in AnnotatableDirective (Global...); Add Semicolon the other occurrences of VariableDefinition in AnnotatableDirective; Add Semicolon to occurrences of TypeDefinition and NamespaceDefinition in AnnotatableDirectives; Remove TypeDefinition from InterfaceDefinition; Fix various arguments in RelationalExpression; Fix argument in AnnotatableDirective (class); Add Semicolon to FunctionDeclaration production in AnnotatableDirective (interface); Add interface argument to NamespaceAttribute in Attribute (interface); Add NamespaceAttribute (interface); Replace 'intrinsic' with 'external' in NamespaceAttribute rules; Remove Attribute (local); Remove definition and use of OverloadedOperator; Rename InitialiserList to SettingList and Initialiser to Setting; Make TypeReferenceList left recursive; Rename PackageAttributes to PackageAttribute

**30-Mar-2008:** Rename ListExpression to CommaExpression; Make CommaExpression a binary expression in the AST; Change ParenExpression to ParenListExpression in SuperExpression; Rename ParenListExpression to ParenExpression; Remove Path qualified PropertyNames; Mark reserved/deferred features with 'x'; Remove 'wrap'; Remove 'like' as a type; Add 'like' as a binary type operator; Remove LetStatement; Remove UnitDefinition; Fold NullableTypeExpression into TypeExpression; Remove OverloadedOperator from QualifiedNameIdentifier; Add distinguishing syntax for tuples and array types in ArrayType; Add SplatExpression to arguments and array literals; Add RestPattern to array patterns; Add to ReservedIdentifiers 'type'; Add to ContextuallyReservedIdentifiers 'external'; Removed from ContextuallyReservedIdentifiers 'decimal', 'double', 'generic', 'int', 'Number', 'precision', 'rounding', 'standard', 'to', 'uint', 'unit'; Add LikedPattern to Parameter; Add LikePredicate to ResultType; Remove ParameterKind and use in Parameter

**20-Mar-2008:** Use noColon parameter before : in ConditionalExpression and NonAssignmentExpression; Swapped [PropertyName, QualifiedName] => [QualifiedName, PropertyName]; Removed . AttributeName from PropertyOperator; Add AttributeName to PrimaryName; Rename Brackets to BracketsOrSlice; Add Brackets, without slice; Change Brackets in PropertyOperator to BracketsOrSlice; Add TypeUnionList etc to allow for | list separators and empty unions; Move LetExpression from ConditionalExpression to PrimaryExpression; Move the UnaryTypeExpression from PostfixExpression to ConditionalExpression and NonAssignmentExpression; Replace TypedExpression with ParenListExpression; Remove TypedExpression; Remove import aliasing; Add ReservedNamespace to PrimaryExpression; Add "." syntax to PropertyOperator for E4X compatibility; Remove "intrinsic" from ReservedNamesapce and ContextuallyReservedIdentifiers; Add TypeApplication syntax to BasicTypeExpression (got dropped by ealier refactoring); Refactored CaseElementsPrefix; Change PrimaryNameList to TypeReferenceList in InterfaceInheritance (typo)

**04-Dec-2007:** Add productins for AnnotatableDirective(class,...)

**31-Oct-2007:** Add 'wrap' to ReservedIdenifiers; Move 'is' and 'cast' from ContextuallyReservedIdentifiers to ReservedIdentifiers; Add version number for which each production applies

**23-Oct-2007:** Add 'wrap' operation to RelationalExpression; Add 'like' type expression; Rename root type expression from NullableType to TypeExpression

**17-Oct-2007:** Change 'this callee' to 'this function'; Remove 'callee' from ContextuallyReservedIdentifiers; Add TypeReference and TypeReferenceList; Replace use of PrimaryName and PrimaryNameList in ClassInheritance and InterfaceInheritance with TypeReference and TypeReferenceList; Remove [No newline] constraint in ReturnStatement; Add Semicolon after DoStatement; Minor reordering of productions in PrimaryExpression; Rename ObjectType to RecordType; Initial definition of mapping from concrete to abstract syntax

**14-Oct-2007:** Remove 'type' TypeExpression from UnaryExpr; Add UnaryTypeExpression; Change uses of TypeExpression to NullableTypeExpression for symmetry with TypeDefinitions; Restore use of 'undefined' in TypeExpression (although ambiguous, provides clarity); update 'use decimal' pragma; Rename DeconstructingField\* to Field\*Pattern and DeconstructingElement\* to Element\*Pattern; Change "Path . Identifier" in NamespaceAttribute to PrimaryName; Remove Identifier from NamespaceAttribute

**04-Oct-2007:** Replace Identifier with NonAttributeQualifiedIdentifier in FieldName; Add ReservedNamespace to Qualifier; Change arguments to Pattern in Initialiser to allowIn, allowExpr; Remove Semicolon after DoStatement; Add TypeApplication to PropertyIdentifier; Remove PropertyName; Rename NonAttributeIdentifier to PropertyName; Remove default from TypeCaseElement; Remove duplicate production for XMLElementContent

**22-Aug-2007:** Fix several cases of missing rule arguments; Move use of Semicolon out of VariableDefinition

**21-Aug-2007:** Remove '\*' from QualifiedNameIdentifier; Rename use of AttributeIdentifier to AttributeName in PrimaryExpression; Add SwitchTypeStatement to Statement; Replace ClassName with Identifier TypeSignature in InterfaceDefinition and FunctionDefinition; Replace ParameterisedTypeName with Identifier TypeSignature in TypeDefinition; Fix various other typos found by E. Suen

**20-Aug-2007:** Remove LiteralField without value; Add FieldName without pattern to DestructuringField; Move null and undefined from NullableTypeExpression to TypeExpression; Erase ToSignature; Distinguish FunctionExpressionBody from FunctionBody; Move Semicolon into specific definition rules that use them; Add UnitDefinition; Fix use unit pragma; Factor out ClassSignature from ClassName (now just Identifier); Replace use of SimpleQualifiedName with PrimaryName in NamespaceInitialiser; Rename RecordType to ObjectType; Change String to StringLiteral; Number to NumberLiteral in QualifiedNameIdentifier; Remove ambiguous ReservedNamespace in Qualifier; Remove 'undefined' from TypeExpression; Add 'callee' and 'generator' to ContextuallyReservedIdentifiers

**23-Jul-2007:** Require Block body in LetStatement; Fixed missed renames of \*Identifier to \*Name; Allow trailing common in ObjectLiteral; Make 'debugger' a reserved identifier; Add 'this callee' and 'this generator' as a primary expressions; Simplified TypedPattern; Change prefix of type application from TypeExpression to ParenListExpression; Remove 'null' and 'undefined' from TypeExpression; Require semicolon after braceless function body; Various fixes to the beta argument; Add alpha parameter to indicate contexts which allow annotations on object and array literals; Fix missed replacement of PrimaryIdentifier with PrimaryName; Add Unit pragmas; Relax rules that packages must come before any other directive (make PackageDefinition a Directive)

**29-May-2007:** Add types 'null' and 'undefined' to TypeExpression; Rename Identifier to Name; add non-terminal QualifiedNameIdentifier to hold various kinds of identifiers; Add TypedExpression and use in head of WithStatement and SwitchTypeStatement; Change name of get and set fields to FieldName; Eliminate distinction between NullableTypeExpression and TypeExpression;

**23-May-2007:** Fix list comprehensions; Remove 'debugger' and 'include' from ContextuallyReservedIdentifier; Change body of yield, let and function expressions from ListExpression to AssignmentExpression; Remove use of the alpha parameter to distinguish allowList from noList uses of yield, let and function expressions; Add optional Qualifier to FieldName

**10-Apr-2007:** Fix several typos; Add to SimpleQualifiedIdentifier syntax for calling global intrinsic overloadable operators

**06-Apr-2007:** Replace errant references to TypeIdentifier with PropertyIdentifier; Move from ReservedIdentifiers to ContextuallyReservedIdentifiers: cast const implements import interface internal intrinsic is let package private protected public to use; Remove ReservedIdentifier: as; Add missing allowIn argument to uses of FunctionBody; Remove lexical non-terminal PackageIdentifiers

**30-Mar-2007:** Replace TypeIdentifier in PrimaryExpression with PrimaryIdentifier; Inline PropertyIdentifier production; Rename TypeIdentifier to PropertyIdentifier; Remove function names with embedded \*

**29-Mar-2007:** Revert previous restriction that 'use default namespace' argument must be a particular reserved namespace; Add tau parameter to BlockStatement and Block to allow top-level blocks with hoisted definitions; Rename ParameterisedClassName to ParameterisedTypeName; Change Identifier in TypeDefinition to ParameterisedTypeName; Replace the lexeme PackageIdentifier with the nonterminal Path, which gets resolved to a PackageName or an object reference by the definer; Move the ListExpression form of function body into FunctionBody; Add PrimaryIdentifier production and move Path qualified references out of TypeIdentifier to PrimaryIdentifier; Change right side of PropertyOperator from QualifiedIdentifier to TypeIdentifier; Add 'has' to the ContextuallyReservedIdentifiers; Update FunctionName to include 'call' and 'has' functions; Remove 'invoke' from ContextuallyReservedIdentifiers

**13-Mar-2007:** Add SuperInitialiser to as optional final constituent of ConstructorInitialiser; Erase SuperStatement; Erase "const function" from the class context (all methods are const); Restrict use default namespace argument to public, internal and intrinsic; Remove 'in' from ContextuallyReservedIdentifiers; Define 'function to' so that no return type is allowed; Remove 'construct' from ContextuallyReservedIdentifiers; Add 'invoke' to ContextuallyReservedIdentifiers

**02-Mar-2007:** Erase gamma parameter from TypedPattern (always noExpr); Add syntax for array comprehension; Rename ElementList to Elements; Rename FieldList to Fields; Rename NonemptyFieldList to FieldList; Add "const function" definition syntax; Change PropertyIdentifier to \* in function call definitions; Rename call to invoke in non-catchall definitions; Remove 'construct' function; Update PackageIdentifier; Remove '^' and '^=' punctuators; Fork FunctionSignatureType from FunctionSignature; Fix bug which allowed "this : T," in FunctionSignature; Make 'null' and 'undefined' NullableTypeExpressions; Add 'undefined' to ContextuallyReservedIdentifiers

**18-Jan-2007:** Add syntactic parameter  $\tau$  to distinguish between contexts that allow / exclude certain kinds of definitions; Add syntax for constructor definitions, including ConstructorInitialiser; Add syntax to FunctionSignature to constrain type of 'this'; Distinguish between nullable/nonnullable and other type expression; Allow any TypeExpression in TypedPattern

**08-Dec-2006:** Add FieldKind to LiteralField; Change NonAttributeQualifiedIdentifier to PropertyIdentifier in FieldName; Remove [no line break] constraint from FunctionName; Add to FunctionName productions for 'construct' and for 'call' and 'to' without a name; Add 'construct' to ContextuallyReservedIdentifiers

**06-Dec-2006:** Add BlockStatement non-terminal, minor refactoring of the Program productions; Rename PackageDefinition as Package; Change NonAttributeQualifiedIdentifier to FieldName in DestructuringField; Change SwitchTypeStatement to take a ListExpression and TypeExpression in its head rather than a binding form; Merge LogicalAssignmentOperator into CompoundAssignmentOperator; Rename Inheritance to ClassInheritance; Rename ExtendsList to InterfaceInheritance; Refactor InterfaceDefinition to have a more specific syntax;

**29-Nov-2006:** Update AST nodes for VariableDefinition; Update AST nodes for Pragmas; Change rhs of SimplePattern from PostfixExpression to LeftHandSideExpression; Tighten the syntax of definition attributes that are reference to namespaces; Add AST nodes for SwitchStatement and SwitchTypeStatement

**21-Nov-2006:** Make the 'cast' operator a peer of the infix 'to' operator; Propagate the  $\alpha$  parameter to FunctionExpression; Unify TypedIdentifier and TypedPattern, and lhs postfix expressions and Pattern; Remove logical xor operator; Add 'precision' to PragmalIdentifier and ContextuallyReservedIdentifier; Add AST node types for expressions; Refactor slice syntax; Remove empty bracket syntax

**14-Nov-2006:** Move 'yield' from Reserved to contextually reserved; Add ReservedIdentifier after '::' in ExpressionQualifiedIdentifier; Refactor RestParameter; Remove abstract function declaration from FunctionCommon; Add accessors to ObjectLiteral; Move TypedIdentifier and TypedPattern to the Expressions section; Remove FieldName : ParenExpression; Remove ExpressionClosure; Add expression closure syntax to FunctionExpression; Propagate the  $\beta$  parameter down to FunctionExpression; Distinguish between RecordType and ArrayType in TypedPattern; Rename noLet and allowLet to noList and allowList, respectively; Add «empty» to DestructuringFieldList; Added links to 'triple quotes' and 'extend regexp' proposals

**26-Sep-2006:** Add ReservedIdentifier after '::'; Parameterise productions to restrict the context where LetExpression and YieldExpression can be used; Change the body of LetExpression and YieldExpression from AssignmentExpression to ListExpression

**21-Sep-2006:** Rename lexical non-terminals 'String' to 'StringLiteral' and 'Number' to 'NumberLiteral'; Remove infix 'cast' expressions; Remove prefix 'to' expressions; Change the rhs of 'to' to be a TypeExpression; Move 'yield' to 'AssignmentExpression' (again); Replace Arguments with ParenExpression in SuperExpression

**15-Sep-2006:** Add rules for tagging an object or array literal with a structural type; Add "decimal", "double", "int", "uint", "Number", "rounding", "strict", and "standard" to the list of ContextuallyReservedIdentifiers; Fix capitalisation of PackageIdentifier (409); Add definition of lexical Identifier; Remove redundant productions referring to ContextuallyReservedIdentifier; Add "Number" as a PragmaArgument; Refactor YieldExpression to be used by MultiplicativeExpression and use UnaryExpression

**30-Aug-2006:** Remove 'native' from ReservedIdentifier; Add lexical non-terminals for missing literal forms and VirtualSemicolon; Replace productions for Identifier with one that uses lexical symbol ContextuallyReservedIdentifiers; Replace RestParameters with RestParameter (57); Replace VariableDefinition with ListExpression (94,99,101,106); Replace NonAssignmentExpression with LogicalOrExpression (219); Remove unused production for DestructuringAssignmentExpression (250); Remove Statement production for SwitchTypeStatement (291); Sort Statement productions; Remove unused productions for Substatements and SubstatementsPrefix; Replace use of VariableInitialiser with AssignmentExpression (441); Replace uses of TypeName with TypedIdentifier (462,463); Rename TypeNameList as TypedIdentifierList

**15-Jun-2006:** Add 'yield' expression without subexpression; Remove Semicolon after PragmaItems in UsePragma; Remove parens around PragmaArgument in PragmaItem; Change SimpleQualifiedIdentifier to SimpleTypedIdentifier in PragmaArgument; Add SimpleTypedIdentifier to NamespaceInitialisation

**07-Jun-2006:** Remove AttributeCombination from Attributes; Remove true and false from Attributes (they are a carryover from the NS proposal and have never been proposed here); Added comment on the creation of a lexical PackageIdentifier from a syntactic PackageName; Allow 'let' on VariableDefinition and FunctionDefinition; Merge SwitchType into SwitchStatement; Add 'call' to context keywords and syntactic identifier; Replace ListExpression in Arguments with ArgumentList; Reuse VariableBinding for LetBinding; Add ParameterAttributes to Pattern in Parameter; Add TypedParameter to RestParameter; Change Identifier to TypedIdentifier in RestParameter; Add TypedPattern to TypeCaseElement; Rename 'private' to 'internal' in PackageAttributes

**01-Jun-2006:** Add '!' to ClassName; Remove 'as'; Replace TypeExpression on the rhs of 'is' and 'to' with ShiftExpression; Rename AttributeQualifiedIdentifier to AttributIdentifier; Add 'type' operator to UnaryExpression; Change yield construct from YieldStatement to YieldExpression; Add 'yield' to the list of reserved identifiers; Add TypedPattern everywhere that TypedIdentifier is used to defined a variable, except in switch-type; Define the meaning of the lexical symbol PackageIdentifier; Add primary expression for "to" and binary expression for "cast"

**23-May-2006:** Add 'super' to reserved words; Refactor TypIdentifier; Use simpler E3 syntax for PostfixExpression; Rename LPattern and children to Pattern etc.; Move DestructuringAssignmentExpression out of AssignmentExpression; Move LetExpression to AssignmentExpression; Remove attribute blocks; Remove variable initialiser with multiple attributes on the rhs; Add parens around pragma arguments; Add prama identifiers 'default namespace' and 'default package'; Add PackageAttribute to PackageDefinition; Sort rules for readability

**16-May-2006:** Added '.' before '<...>' in type definitions; removed ReservedNamespace from PrimaryExpression since it is already include via QualifiedIdentifier; simplified PostfixExpression; changed qualifier on ExpressionQualifiedIdentifier from ParenExpression to ParentListExpression; Refactored TypIdentifier; replaced QualifiedIdentifier with TypIdentifier and added AttributeQualifiedIdentifier in PrimaryExpression; made .< a token rather than two; Redefined TypeParameters to include the .< and > delimiters

**15-May-2006:** Moved 'PackageIdentifier . Identifier' from PrimaryExpression to QualifiedIdentifier; Added dot to left angle brace for parameterized type expressions in TypeExpression

**12-May-2006:** Initial draft. First attempt to capture the whole grammar of ES4. Current with the latest proposals