

# Entrées/sorties

Pratique de la programmation orientée-objet  
Michel Schinz – 2018-03-05

# Flots en Java (`java.io`)

Le flot (*stream*) est l'abstraction centrale des entrées/sorties de `java.io`. Il y en a quatre types :

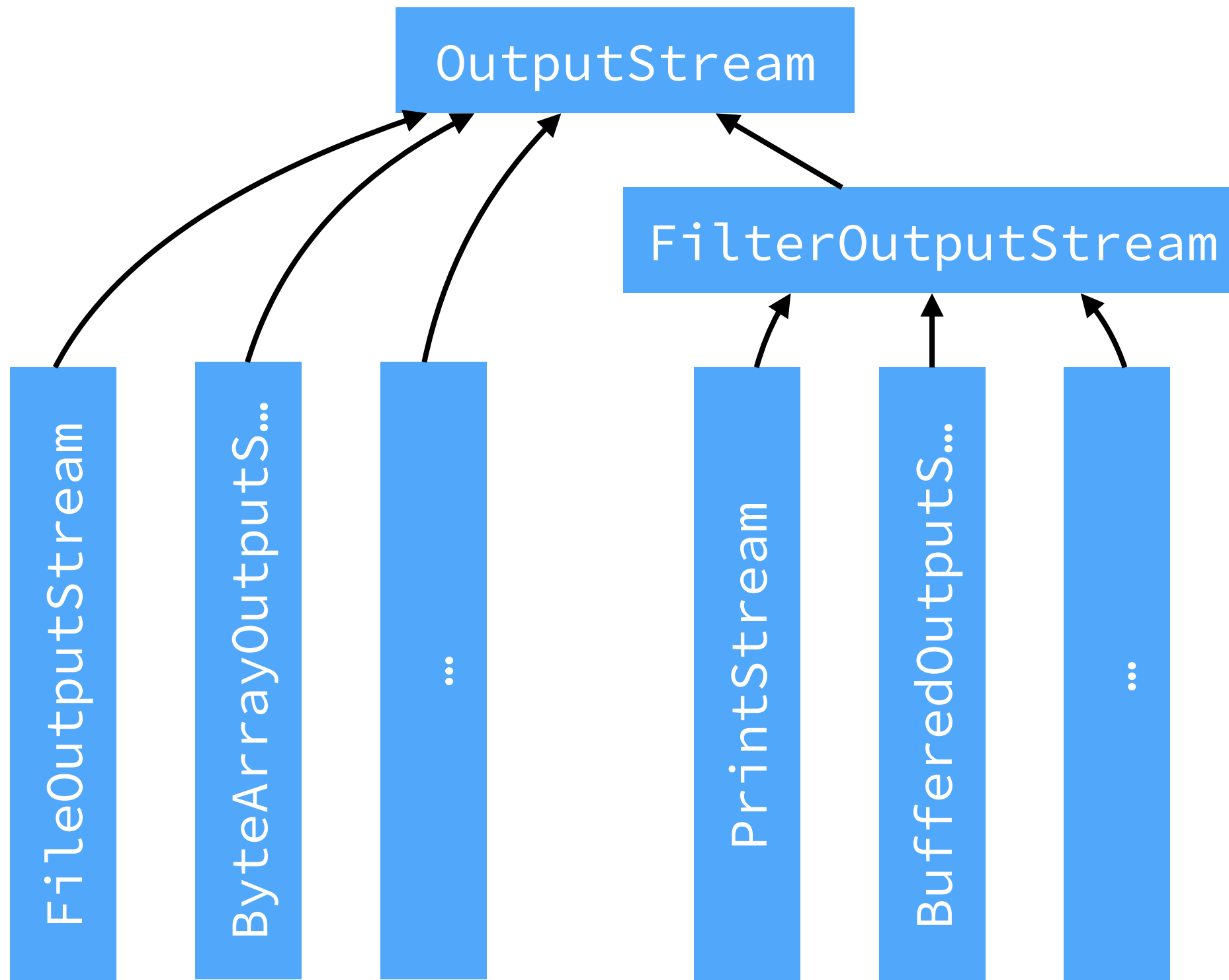
	Entrée	Sortie
Octets	<code>InputStream</code>	<code>OutputStream</code>
Caractères	<code>Reader</code>	<code>Writer</code>

A chaque type de flot, représenté par une classe abstraite, correspond une hiérarchie.

# OutputStream

```
abstract public class OutputStream {  
    // Ecrit les 8 bits de poids faible de b  
    // dans le flot.  
    abstract void write(int b);  
  
    // Ecrit la totalité des octets de b dans  
    // le flot.  
    void write(byte[] b);  
  
    // Ferme le flot.  
    void close();  
}
```

# Flots de sortie d'octets



# InputStream

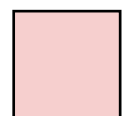
```
abstract public class InputStream {  
    // Lit et retourne le prochain octet du  
    // flot (entier entre 0 et 255) ou -1.  
    abstract int read();  
  
    // Lit et place dans le tableau b les  
    // prochains octets du flot, retourne le  
    // nombre lu ou -1.  
    int read(byte[] b);  
  
    // Ferme le flot.  
    void close();  
}
```

# Représentation des caractères

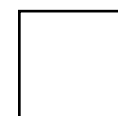
# ASCII (1975)

1 caractère = 7 bits (127 caractères)

PDF : fr en v · d · m	<b>0</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>	<b>7</b>	<b>8</b>	<b>9</b>	<b>A</b>	<b>B</b>	<b>C</b>	<b>D</b>	<b>E</b>	<b>F</b>
<b>000</b>	NUL	SOH	STX	ETX	EOT	ENQ	ACK	BEL	BS	HT	LF	VT	FF	CR	SO	SI
<b>001</b>	DLE	DC1	DC2	DC3	DC4	NAK	SYN	ETB	CAN	EM	SUB	ESC	FS	GS	RS	US
<b>002</b>	SP	!	"	#	\$	%	&	'	(	)	*	+	,	-	.	/
<b>003</b>	0	1	2	3	4	5	6	7	8	9	:	;	<	=	>	?
<b>004</b>	@	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
<b>005</b>	P	Q	R	S	T	U	V	W	X	Y	Z	[	\	]	^	_
<b>006</b>	`	a	b	c	d	e	f	g	h	i	j	k	l	m	n	o
<b>007</b>	p	q	r	s	t	u	v	w	x	y	z	{		}	~	DEL



caractères de contrôle



caractères imprimables

# ISO 8859-1 (1985)

1 caractère = 8 bits (256 caractères)

ISO-8859-1																
	-0	-1	-2	-3	-4	-5	-6	-7	-8	-9	-A	-B	-C	-D	-E	-F
0-	NUL	SOM	STX	ETX	EOF	ESC	ACK	BEL	BS	HT	LF	VT	FF	CR	SO	SI
	0000	0001	0002	0003	0004	0005	0006	0007	0008	0009	000A	000B	000C	000D	000E	000F
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1-	DEL	DC1	DC2	DC3	DC4	MAK	FSM	ITS	CAN	EM	FSM	ESC	FI	SS	RS	US
	0010	0011	0012	0013	0014	0015	0016	0017	0018	0019	001A	001B	001C	001D	001E	001F
	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
2-	SP	!	"	#	\$	%	&	'	(	)	*	+	,	-	.	:
	0020	0021	0022	0023	0024	0025	0026	0027	0028	0029	002A	002B	002C	002D	002E	002F
	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47
3-	0	1	2	3	4	5	6	7	8	9	:	;	<	=	>	?
	0030	0031	0032	0033	0034	0035	0036	0037	0038	0039	003A	003B	003C	003D	003E	003F
	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63
4-	@	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
	0040	0041	0042	0043	0044	0045	0046	0047	0048	0049	004A	004B	004C	004D	004E	004F
	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79
5-	P	Q	R	S	T	U	V	W	X	Y	Z	[	\	]	^	_
	0050	0051	0052	0053	0054	0055	0056	0057	0058	0059	005A	005B	005C	005D	005E	005F
	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95
6-	`	a	b	c	d	e	f	g	h	i	j	k	l	m	n	o
	0060	0061	0062	0063	0064	0065	0066	0067	0068	0069	006A	006B	006C	006D	006E	006F
	96	97	98	99	100	101	102	103	104	105	106	107	108	109	110	111
7-	p	q	r	s	t	u	v	w	x	y	z	{		}	~	DEL
	0070	0071	0072	0073	0074	0075	0076	0077	0078	0079	007A	007B	007C	007D	007E	007F
	112	113	114	115	116	117	118	119	120	121	122	123	124	125	126	127
8-	PA0	PA1	PA2	PA3	PA4	PA5	PA6	PA7	PA8	PA9	VT0	PL0	PL1	PL2	PL3	PL4
	0080	0081	0082	0083	0084	0085	0086	0087	0088	0089	008A	008B	008C	008D	008E	008F
	128	129	130	131	132	133	134	135	136	137	138	139	140	141	142	143
9-	DC0	PA1	PA2	PA3	DC0	PA4	PA5	PA6	PA7	PA8	PA9	DC1	DC2	DC3	DC4	PA0
	0090	0091	0092	0093	0094	0095	0096	0097	0098	0099	009A	009B	009C	009D	009E	009F
	144	145	146	147	148	149	150	151	152	153	154	155	156	157	158	159
A-	8859	i	o	E	=	W		S	-	@	A	<	-	SHY	@	-
	00A0	00A1	00A2	00A3	00A4	00A5	00A6	00A7	00A8	00A9	00AA	00AB	00AC	00AD	00AE	00AF
	160	161	162	163	164	165	166	167	168	169	170	171	172	173	174	175
B-	"	±	z	s	'	µ	¶	'	,	¿	°	»	¼	½	¾	¿
	00B0	00B1	00B2	00B3	00B4	00B5	00B6	00B7	00B8	00B9	00BA	00BB	00BC	00BD	00BE	00BF
	176	177	178	179	180	181	182	183	184	185	186	187	188	189	190	191
C-	À	Á	Â	Ã	Ä	Å	Æ	Ç	È	É	Ê	Ë	Ì	Í	Î	Ï
	00C0	00C1	00C2	00C3	00C4	00C5	00C6	00C7	00C8	00C9	00CA	00CB	00CC	00CD	00CE	00CF
	192	193	194	195	196	197	198	199	200	201	202	203	204	205	206	207
D-	Ð	Ñ	Ò	Ó	Ô	Õ	Ö	×	Ø	Ù	Ú	Û	Ü	Ý	Þ	ß
	00D0	00D1	00D2	00D3	00D4	00D5	00D6	00D7	00D8	00D9	00DA	00DB	00DC	00DD	00DE	00DF
	208	209	210	211	212	213	214	215	216	217	218	219	220	221	222	223
E-	à	á	â	ã	ä	å	æ	ç	è	é	ê	ë	ì	í	î	ï
	00E0	00E1	00E2	00E3	00E4	00E5	00E6	00E7	00E8	00E9	00EA	00EB	00EC	00ED	00EE	00EF
	224	225	226	227	228	229	230	231	232	233	234	235	236	237	238	239
F-	ò	ñ	ó	ô	õ	ö	÷	ø	ù	ú	û	ü	ý	þ	ÿ	
	00F0	00F1	00F2	00F3	00F4	00F5	00F6	00F7	00F8	00F9	00FA	00FB	00FC	00FD	00FE	00FF
	240	241	242	243	244	245	246	247	248	249	250	251	252	253	254	255
	-0	-1	-2	-3	-4	-5	-6	-7	-8	-9	-A	-B	-C	-D	-E	-F



# Unicode (1987-...)

1 caractère = 20 bits (~1 million de caractères)

	000	001	002	003	004	005	006	007
0	<span>NUL</span>	<span>DLE</span>	<span>SP</span>	0	@	P	`	p
1	<span>SOH</span>	<span>DC1</span>	!	1	A	Q	a	q
2	<span>STX</span>	<span>DC2</span>	"	2	B	R	b	r
3	<span>ETX</span>	<span>DC3</span>	#	3	C	S	c	s
4	<span>EOT</span>	<span>DC4</span>	\$	4	D	T	d	t
5	<span>ENO</span>	<span>NAK</span>	%	5	E	U	e	u
6	<span>ACK</span>	<span>SYN</span>	&	6	F	V	f	v
7	<span>BEL</span>	<span>ETB</span>	'	7	G	W	g	w
8	<span>BS</span>	<span>CAN</span>	(	8	H	X	h	x
9	<span>HT</span>	<span>EM</span>	)	9	I	Y	i	y
A	<span>LF</span>	<span>SUB</span>	*	:	J	Z	j	z
B	<span>VT</span>	<span>ESC</span>	+	;	K	[	k	{
C	<span>FF</span>	<span>FS</span>	,	<	L	\	l	
D	<span>CR</span>	<span>GS</span>	-	=	M	]	m	}
E	<span>SO</span>	<span>RS</span>	.	>	N	^	n	~
F	<span>SI</span>	<span>US</span>	/	?	O	_	o	<span>DEL</span>
































































































































































































































































	008	009	00A	00B	00C	00D	00E	00F
0	<span>XXX</span>	<span>DCS</span>	<span>NB SP</span>	°	À	Đ	à	đ
1	<span>XXX</span>	<span>PU1</span>	¡	±	Á	Ñ	á	ñ
2	<span>BPH</span>	<span>PU2</span>	¢	²	Â	Ò	â	ò
3	<span>NBH</span>	<span>STS</span>	£	³	Ã	Ó	ã	ó
4	<span>IND</span>	<span>CCH</span>	¤	´	Ä	Ô	ä	ô
5	<span>NEL</span>	<span>MW</span>	¥	µ	Å	Ö	å	ö
6	<span>SSA</span>	<span>SPA</span>	¦	¶	Æ	Ö	æ	ö
7	<span>ESA</span>	<span>EPA</span>	§	·	Ç	×	ç	÷
8	<span>HTS</span>	<span>SOS</span>	¨	¸	È	Ø	è	ø
9	<span>HTJ</span>	<span>XXX</span>	©	¹	É	Ù	é	ù
A	<span>VTS</span>	<span>SCI</span>	ª	º	Ê	Ú	ê	ú
B	<span>PLD</span>	<span>CSI</span>	«	»	Ë	Û	ë	û
C	<span>PLU</span>	<span>ST</span>	¼	¼	Ì	Ü	ì	ü
D	<span>RI</span>	<span>OSC</span>	½	½	Í	Ý	í	ý
E	<span>SS2</span>	<span>PM</span>	¾	¾	Î	Þ	î	þ
F	<span>SS3</span>	<span>APC</span>	¿	¿	Ï	ß	ï	ÿ

...

← ASCII →

← ISO 8859-1 →

















































































# Unicode (1987-...)

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B	 2A0B	 2A1B	 2A2B	 2A3B	 2A4B	 2A5B	 2A6B	 2A7B	 2A8B	 2A9B	 2AAB	 2ABB	 2ACB	 2ADB	 2AEB	 2AFB
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# Unicode (1987-...)

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6	 13006	 13016	 13026	 13036	 13046	 13056	 13066	 13076	 13086	 13096	 130A6	 130B6	 130C6	 130D6
7	 13007	 13017	 13027	 13037	 13047	 13057	 13067	 13077	 13087	 13097	 130A7	 130B7	 130C7	 130D7
8	 13008	 13018	 13028	 13038	 13048	 13058	 13068	 13078	 13088	 13098	 130A8	 130B8	 130C8	 130D8
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B	 1300B	 1301B	 1302B	 1303B	 1304B	 1305B	 1306B	 1307B	 1308B	 1309B	 130AB	 130BB	 130CB	 130DB
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D	 1300D	 1301D	 1302D	 1303D	 1304D	 1305D	 1306D	 1307D	 1308D	 1309D	 130AD	 130BD	 130CD	 130DD
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# Unicode (1987-...)

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3	 1F603	 1F613	 1F623	 1F633	 1F643
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7	 1F607	 1F617	 1F627	 1F637	 1F647
8	 1F608	 1F618	 1F628	 1F638	 1F648
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A	 1F60A	 1F61A	 1F62A	 1F63A	 1F64A
B	 1F60B	 1F61B	 1F62B	 1F63B	 1F64B
C	 1F60C	 1F61C	 1F62C	 1F63C	 1F64C
D	 1F60D	 1F61D	 1F62D	 1F63D	 1F64D
E	 1F60E	 1F61E	 1F62E	 1F63E	 1F64E
F	 1F60F	 1F61F	 1F62F	 1F63F	 1F64F

# UTF-8

Encodage d'Unicode à taille variable (1 à 4 octets par caractère).

Plage	octet 1	octet 2	octet 3	octet 4
0 à 7F	0xxxxxxx			
... à 7FF	110xxxxx	10xxxxxx		
... à FFFF	1110xxxx	10xxxxxx	10xxxxxx	
... à 1FFFFFFF	11110xxx	10xxxxxx	10xxxxxx	10xxxxxx

# UTF-16

Encodage d'Unicode à taille variable (2 ou 4 octets par caractère) :

- de 0 à D7FF et de E000 à FFFF : représentés tels quels,
- de 10000 à 10FFFF : représentés par 4 octets, au moyen de *surrogate pairs*.

# Reader

```
abstract public class Reader {  
    // Lit et retourne le prochain caractère du  
    // flot (entier entre 0 et  $2^{16}-1$ ) ou -1.  
    int read();  
    // Lit et place dans le tableau c les  
    // prochains caractères du flot, retourne  
    // le nombre lu ou -1.  
    int read(char[] c);  
    // Ferme le flot.  
    void close();  
}
```

# Writer

```
abstract public class Writer {  
    // Ecrit les 16 bits de poids faible de c  
    // dans le flot.  
    void write(int c);  
    // Ecrit la totalité des caractères de a  
    // dans le flot.  
    void write(char[] a);  
    // Ferme le flot.  
    void close();  
}
```