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United States Patent [19]

Rossmann

[11] **Patent Number: 5,809,415**

[45] **Date of Patent: Sep. 15, 1998**

[54] **METHOD AND ARCHITECTURE FOR AN INTERACTIVE TWO-WAY DATA COMMUNICATION NETWORK**

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[73] Assignee: **Unwired Planet, Inc.**, Redwood Shores, Calif.

[21] Appl. No.: **570,210**

[22] Filed: **Dec. 11, 1995**

[51] **Int. Cl.**[6] **H04Q 7/20**

[52] **U.S. Cl.** **455/422**; 455/426; 455/31.3; 455/31.2; 370/352; 370/383; 379/67; 379/89

[58] **Field of Search** ..... 370/352, 383, 370/389, 390, 392, 401; 379/67, 89, 93.07, 93.08, 93.25, 100, 100.11, 114, 201, 207; 455/422, 414, 552, 426, 466, 31.2, 31.3, 550, 557, 575, 556, 564, 566; 364/514 R

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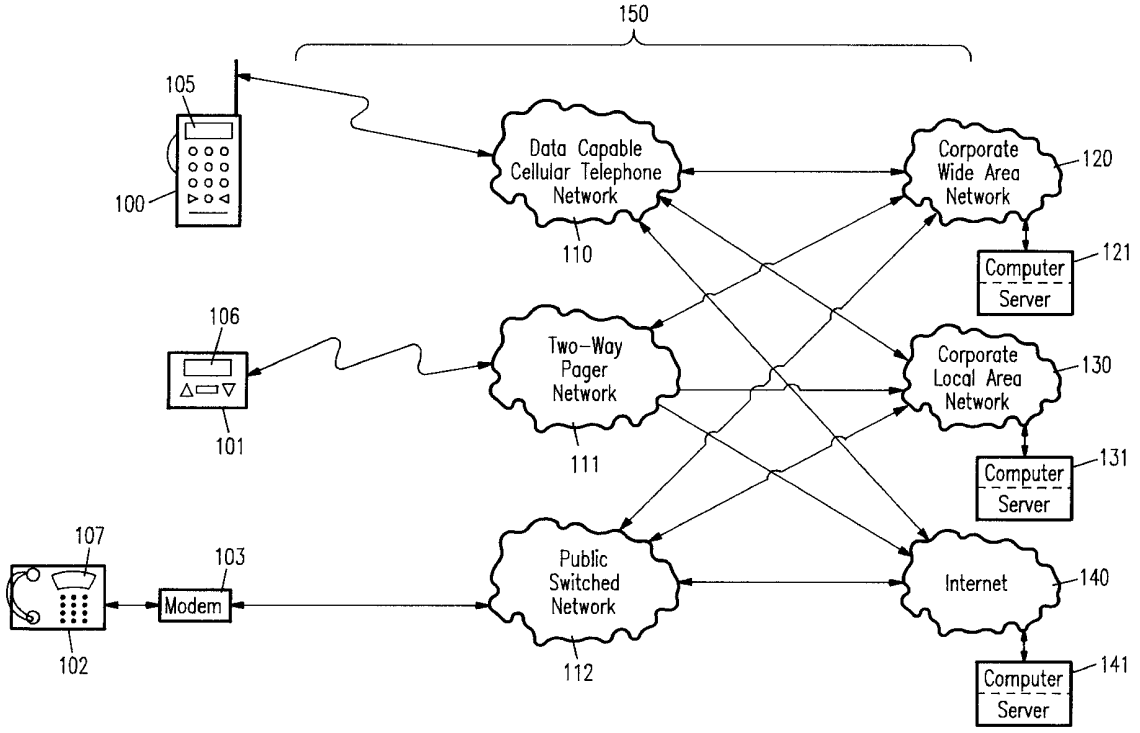
Primary Examiner—Dwayne Bost
Assistant Examiner—Keith Ferguson
Attorney, Agent, or Firm—Skjerven, Morrill, MacPherson, Franklin, & Friel LLP; Forrest E. Gunnison

[57] **ABSTRACT**

A two-way data communication device such as a data ready cellular telephone, a two-way pager, or a telephone communicates via a two-way data communication network with a server computer on a computer network that has an interface to the two-way data communication network, i.e, is coupled to the two-way data communication network. For example, the computer network can be a corporate wide area network, a corporate local area network, the Internet, or any combination of computer networks. The two-way data communication device utilizes a client module to transmit message including a resource selector chosen by the user to a server on a server computer on the computer network. The server processes the message and transmits a response over the two-way data communication network to the client module. The client module interprets the response and presents the response to the user via a structured user interface. Alternatively, the user transmits a request that directs the server to transmit the response to the request to another location or to another user.

54 Claims, 36 Drawing Sheets



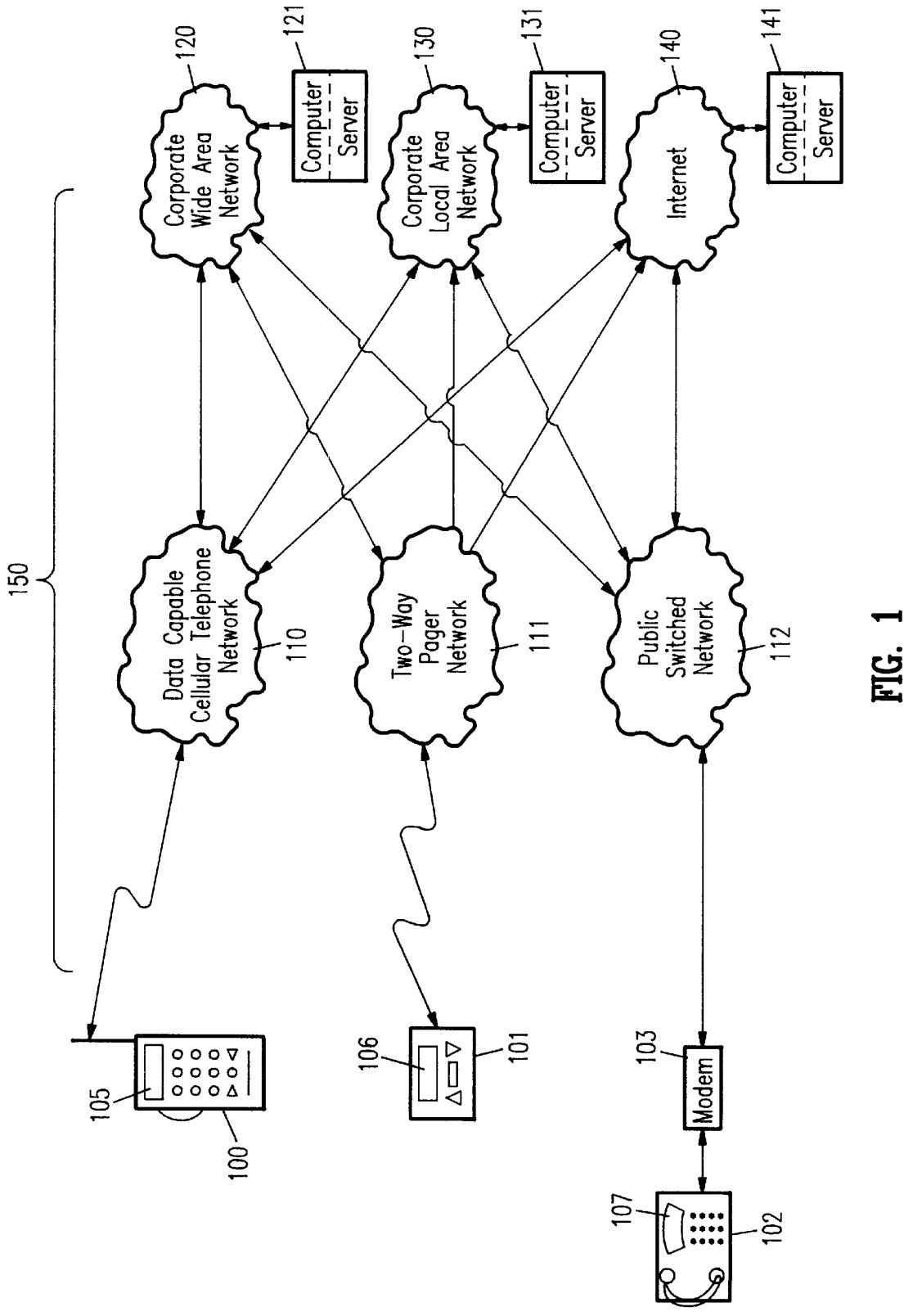


FIG. 1

FIG. 2A

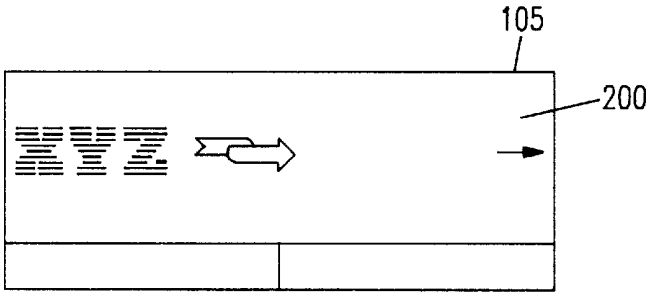


FIG. 2B

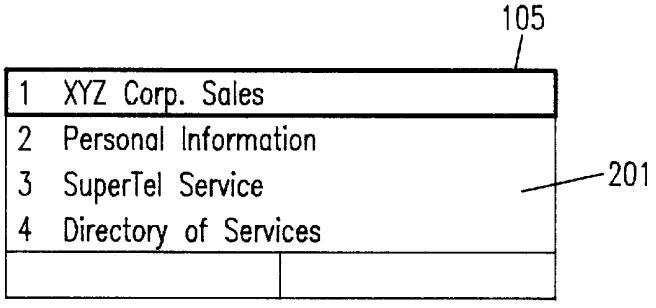


FIG. 2C

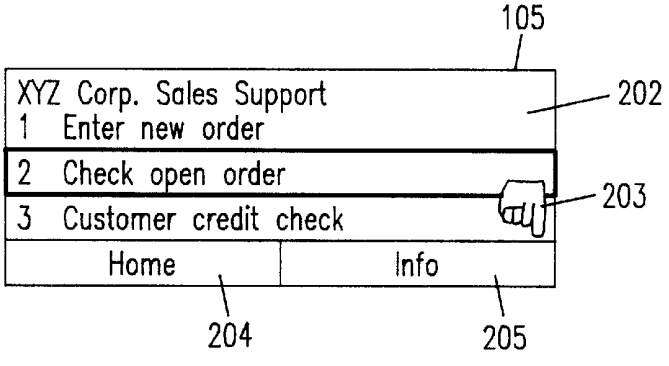


FIG. 2D

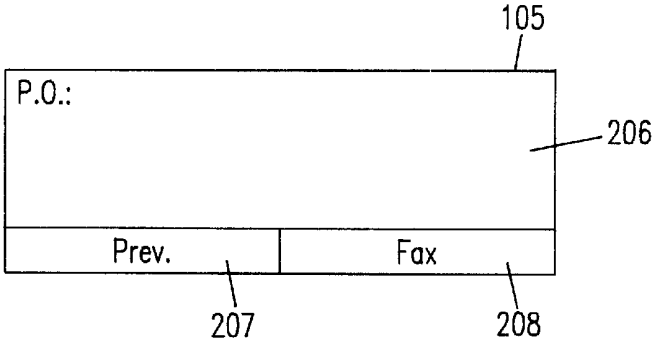


FIG. 2E

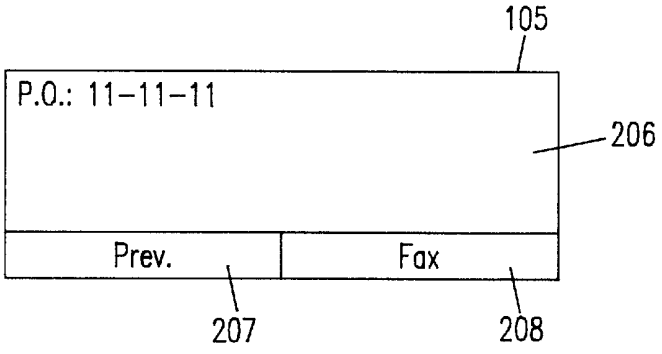


FIG. 2F

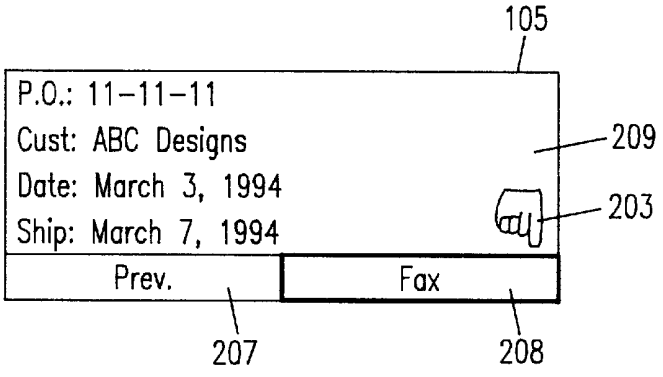


FIG. 2G

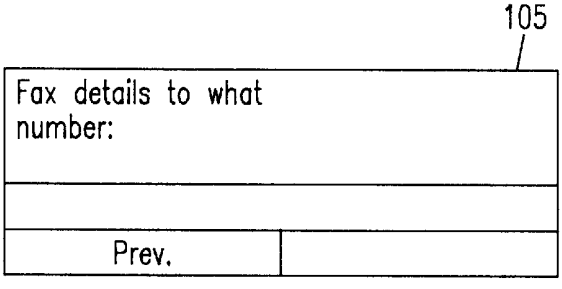
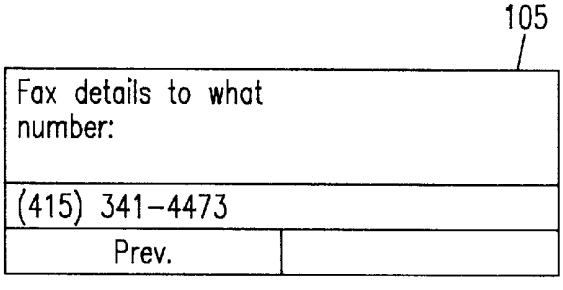


FIG. 2H



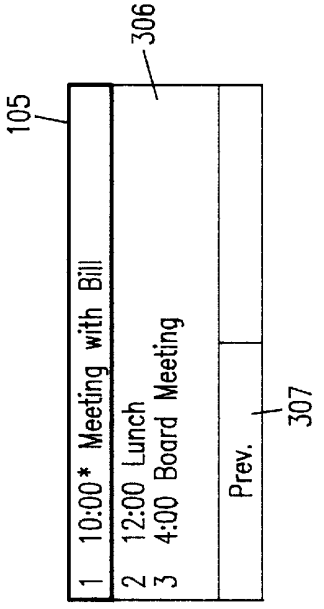


FIG. 3D

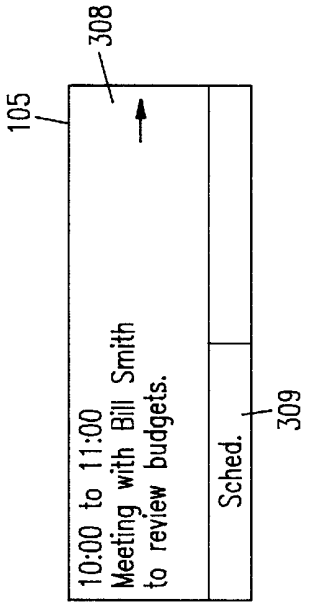


FIG. 3E

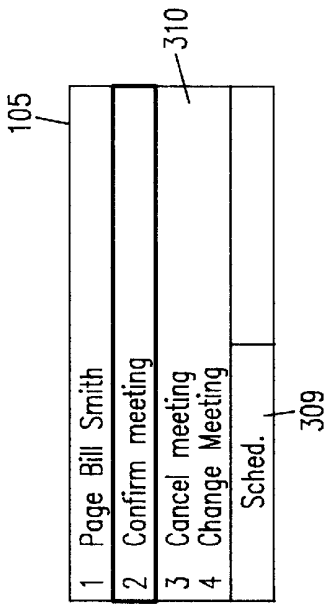


FIG. 3F

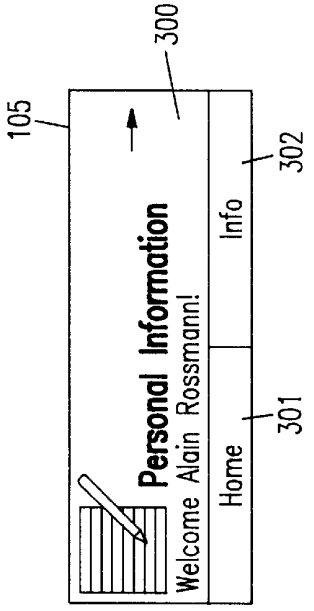


FIG. 3A

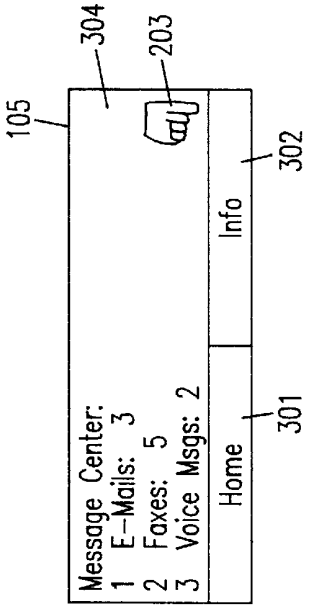


FIG. 3B

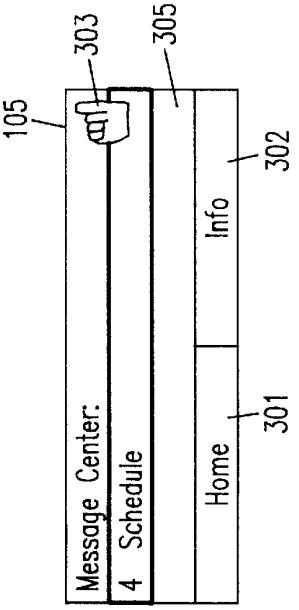


FIG. 3C

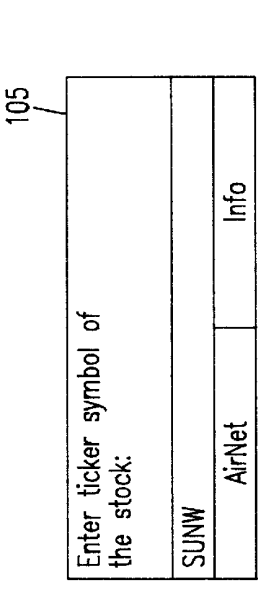


FIG. 4E

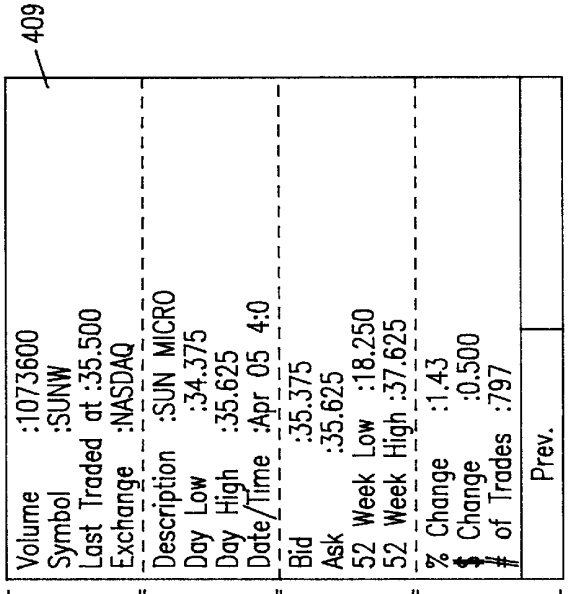


FIG. 4F

FIG. 4G

FIG. 4H

FIG. 4I

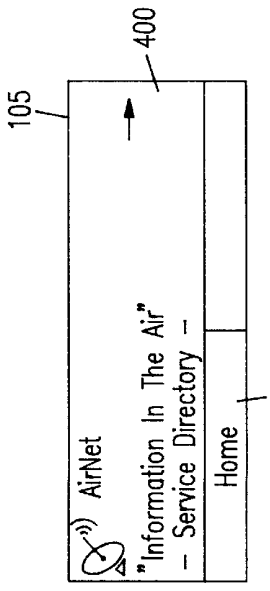


FIG. 4A

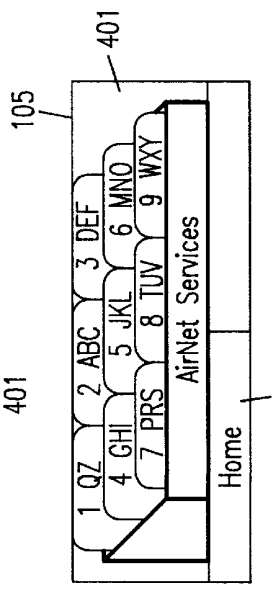


FIG. 4B

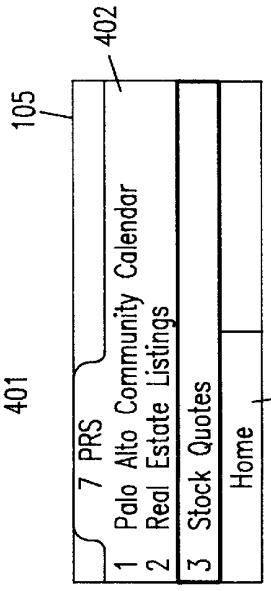


FIG. 4C

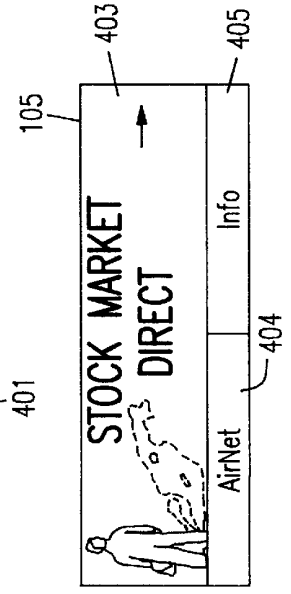


FIG. 4D

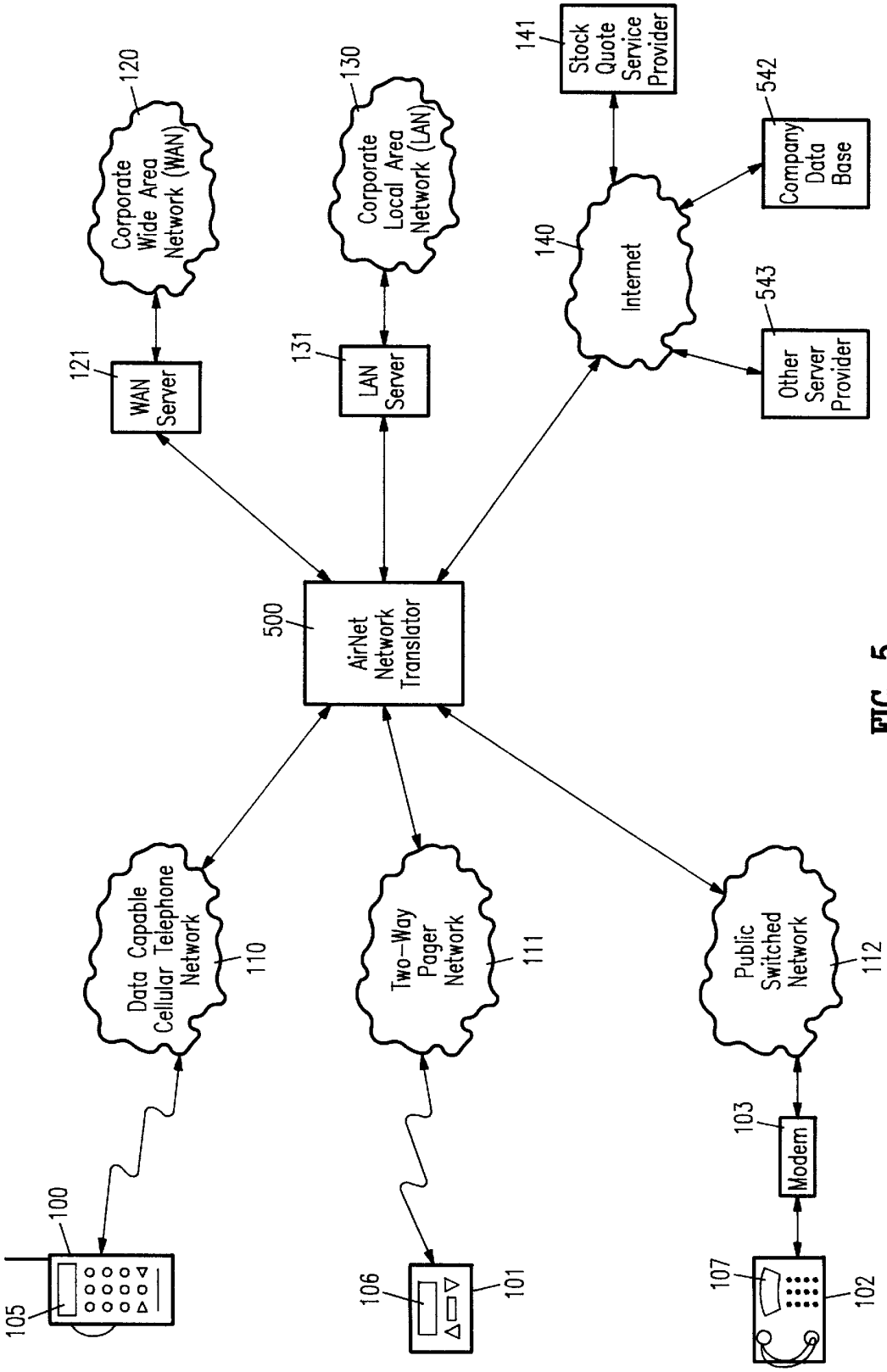


FIG. 5

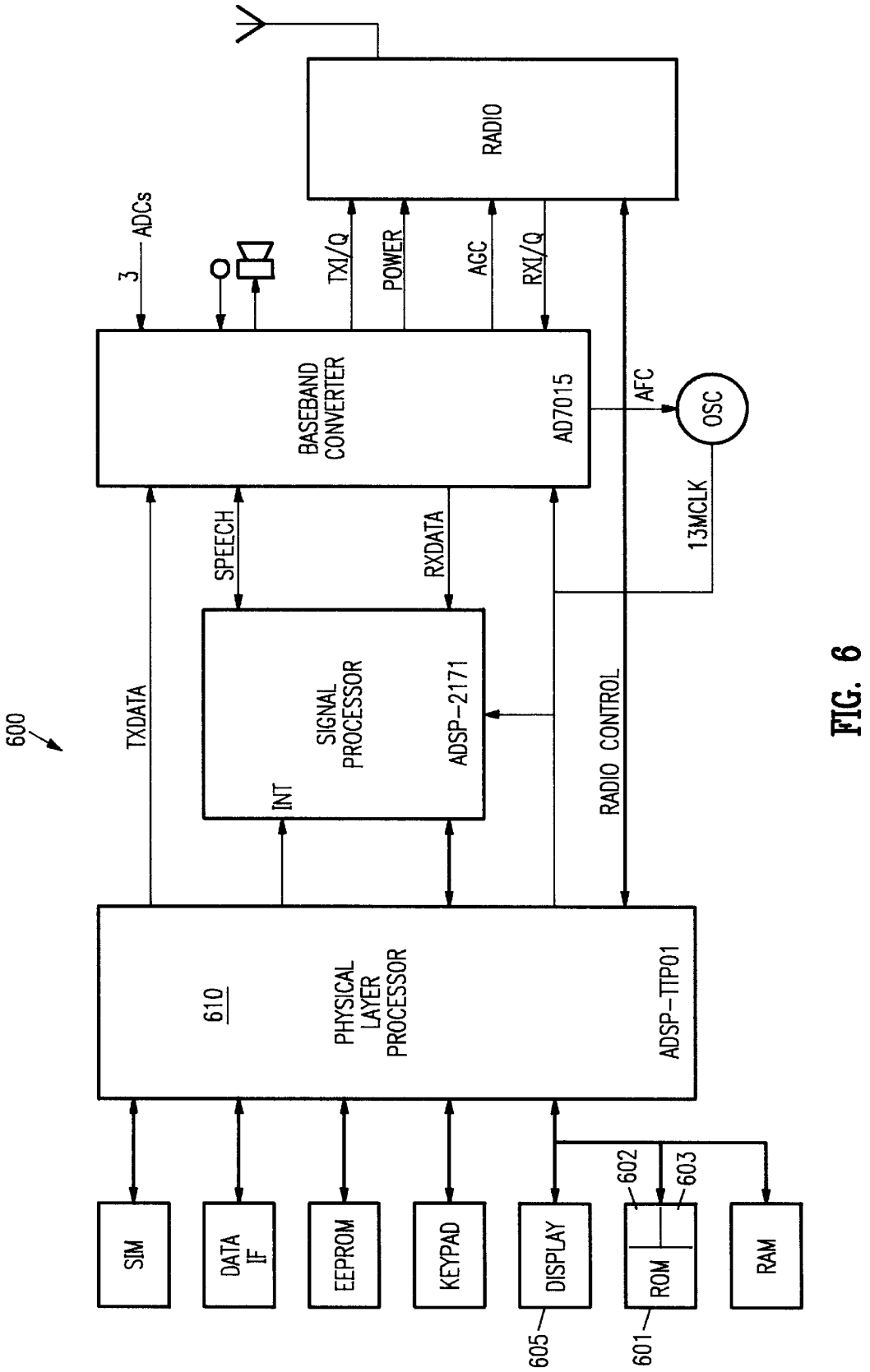


FIG. 6

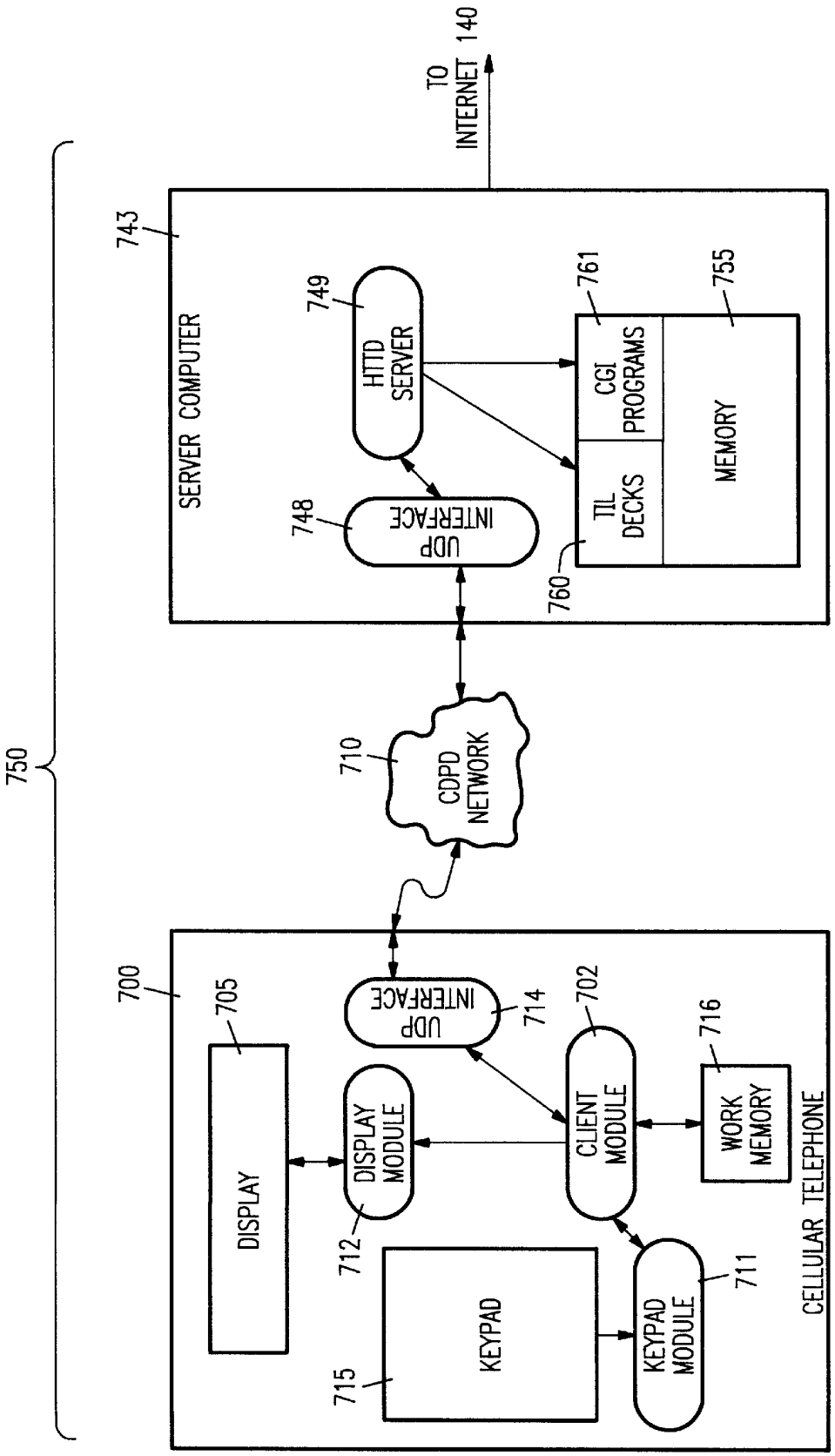


FIG. 7

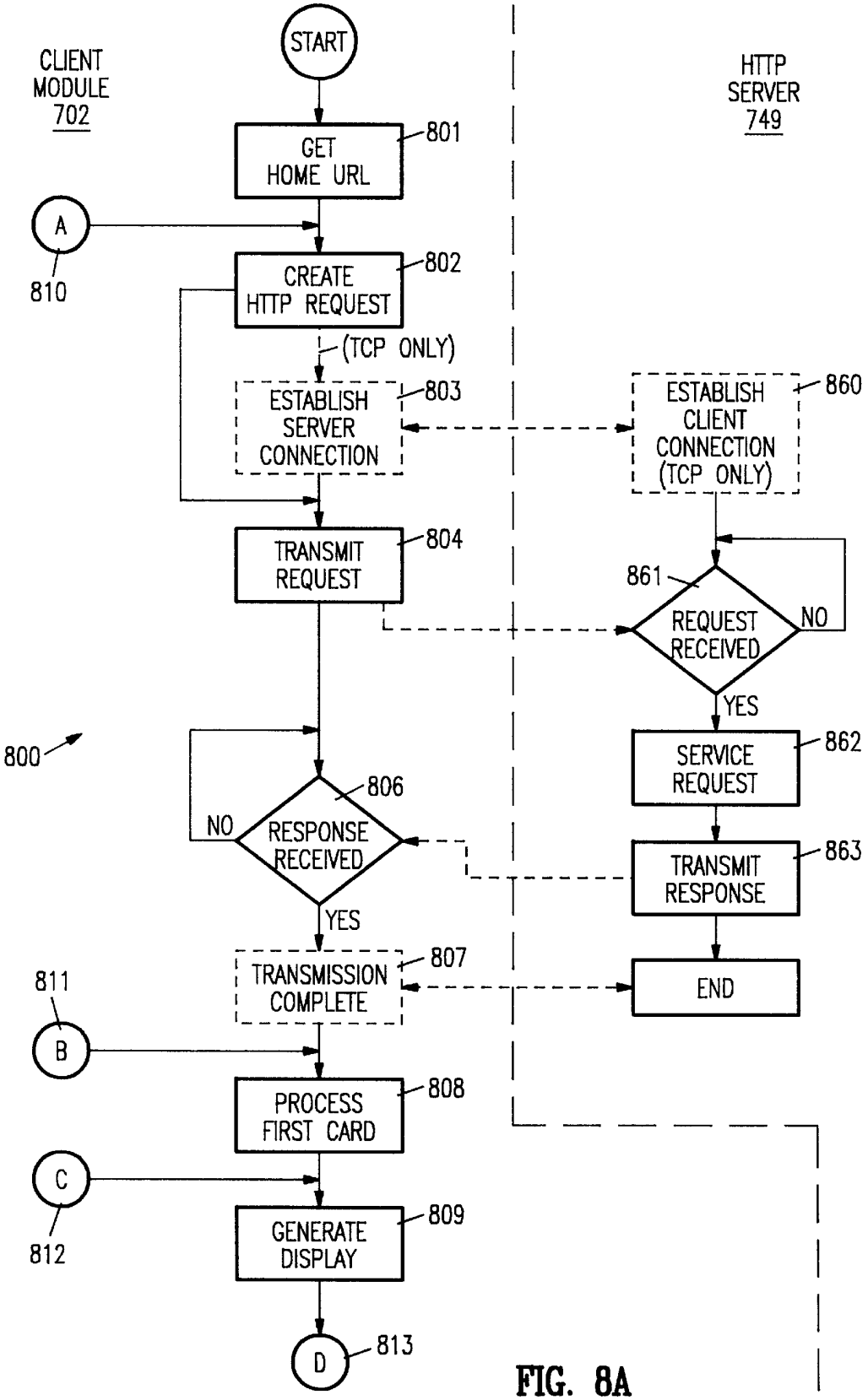


FIG. 8A

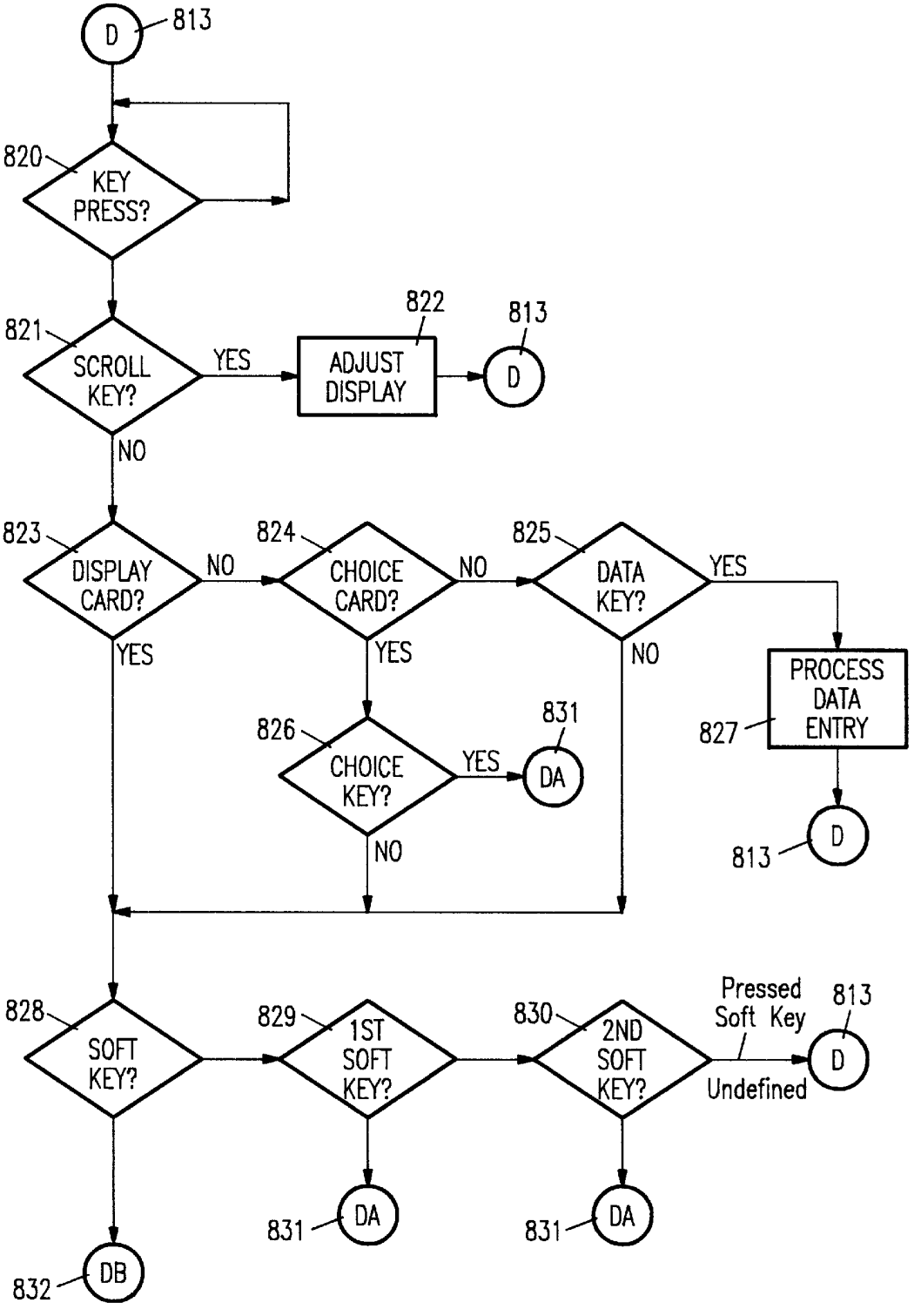


FIG. 8B

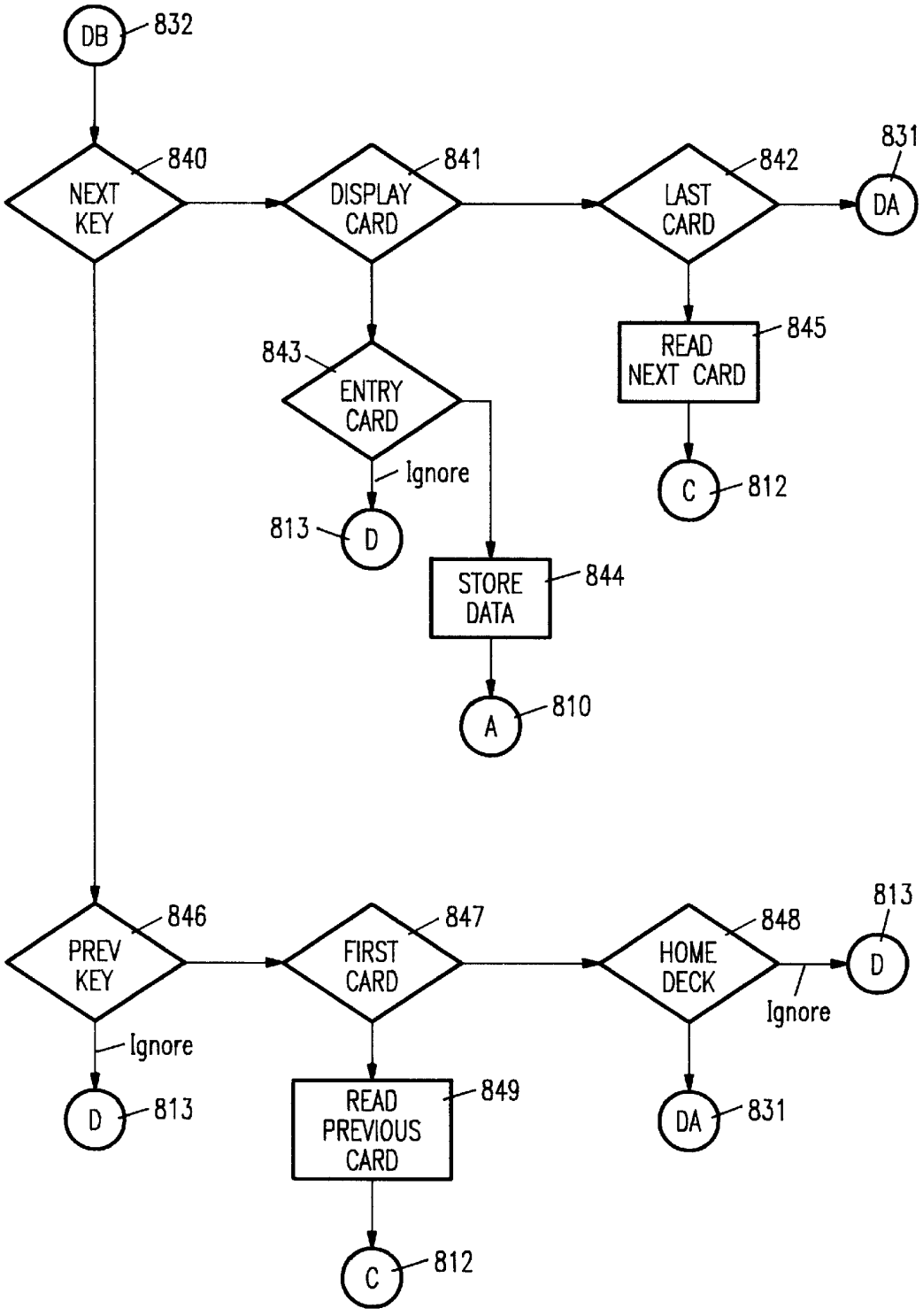


FIG. 8C

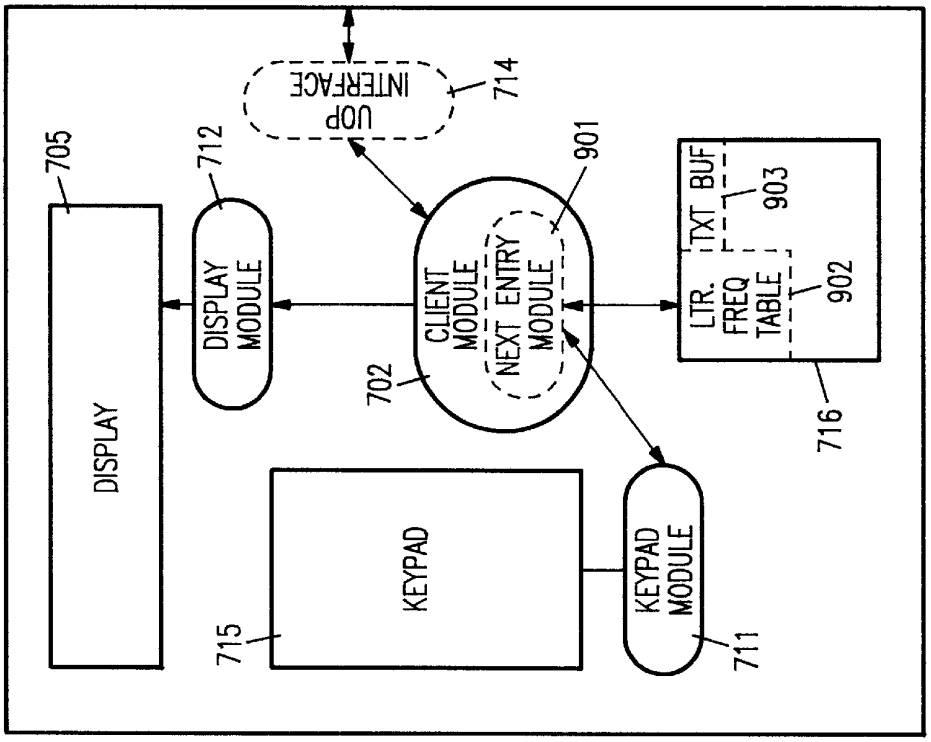


FIG. 9

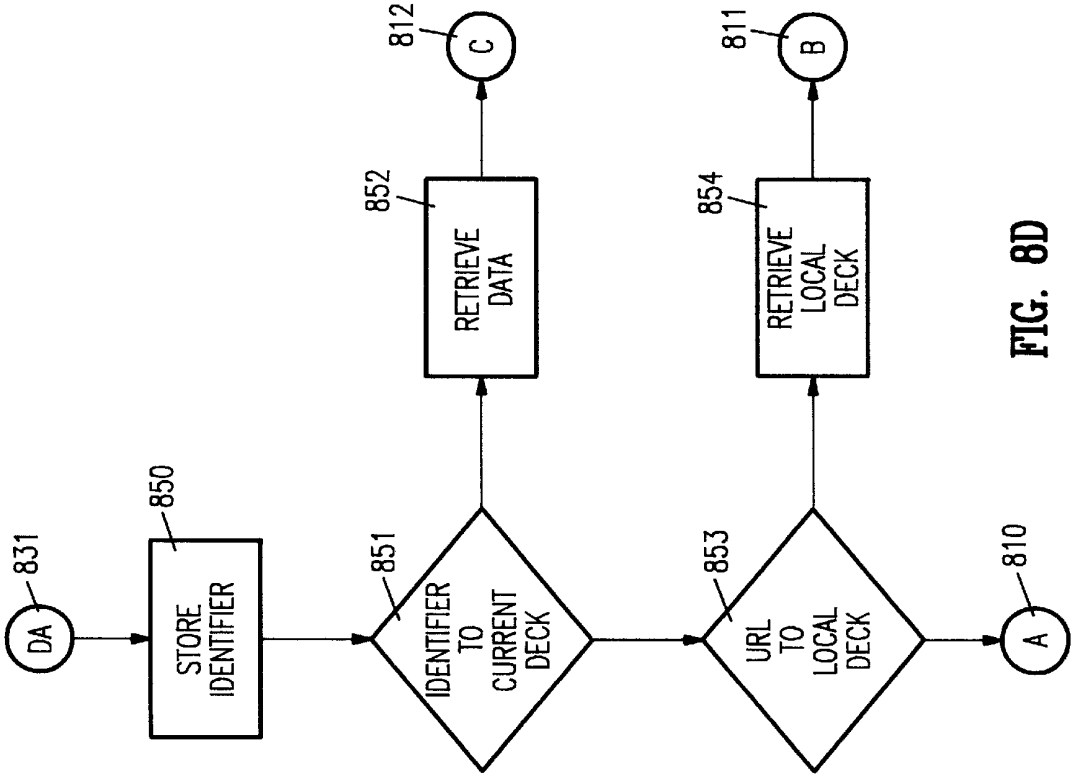


FIG. 8D

"-	-"	1	2	3	4	5	6	7	8	9
"a	a"	q	a	d	g	j	m	r	t	w
"a	b"	q	a	e	i	l	o	r	u	w
"a	c"	q	c	e	h	k	m	r	t	w
"a	d"	q	a	d	i	j	m	s	v	y
"a	e"	q	a	d	g	j	m	p	t	w
"a	f"	q	a	f	g	j	m	r	t	w
"a	g"	q	a	e	i	j	o	r	t	w
"a	h"	q	a	e	g	j	m	p	u	w
"a	i"	q	c	d	g	l	n	r	t	w
"a	j"	q	a	d	g	j	o	p	t	w
"a	k"	q	a	e	i	j	m	s	t	w
"a	l"	q	a	e	i	l	o	s	t	w
"a	m"	q	a	e	i	l	o	p	u	w
"a	n"	q	c	d	g	k	n	s	t	y
"a	o"	q	a	d	g	j	m	p	t	w
"a	p"	q	a	e	h	l	o	p	t	w
"a	q"	q	a	d	g	j	m	s	t	w
"a	r"	q	c	e	g	k	o	r	t	y
"a	s"	q	c	e	i	k	o	s	t	y
"a	t"	q	a	e	i	l	o	s	t	w
"a	u"	q	c	d	g	l	m	s	t	w
"a	v"	q	a	e	i	j	o	p	t	w
"a	w"	q	a	d	g	k	m	p	t	w
"a	x"	q	a	e	i	l	m	s	t	w
"a	y"	q	b	e	i	j	m	s	t	w
"a	z"	q	a	d	i	j	m	p	t	w
"a	"	q	a	d	g	j	m	p	t	w
"b	a"	q	c	d	g	k	n	s	t	y
"b	b"	q	a	d	i	j	m	s	t	y
"b	c"	q	a	d	g	j	o	r	t	w
"b	d"	q	a	d	g	j	m	s	t	w
"b	e"	q	c	e	g	l	n	s	t	x
"b	f"	q	a	d	g	j	m	p	t	w
"b	g"	q	a	d	g	j	m	p	t	w
"b	h"	q	a	d	g	j	m	p	t	w
"b	i"	q	c	d	g	l	n	s	t	w
"b	j"	q	a	e	g	j	m	p	t	w

FIG. 10A

"-	-"	1	2	3	4	5	6	7	8	9
"b	k"	q	a	d	g	j	m	p	t	w
"b	l"	q	a	e	i	j	o	p	t	y
"b	m"	q	a	d	g	j	m	r	t	w
"b	n"	q	a	d	g	j	m	p	t	w
"b	o"	q	a	d	i	j	o	s	u	x
"b	p"	q	a	d	g	j	m	s	t	w
"b	q"	q	a	d	g	j	m	p	t	w
"b	r"	q	a	e	i	j	o	p	u	w
"b	s"	q	c	d	i	j	o	s	t	w
"b	t"	q	a	d	g	j	m	p	t	w
"b	u"	q	a	d	i	l	m	s	t	y
"b	v"	q	a	d	i	j	m	p	t	w
"b	w"	q	a	e	g	j	m	p	t	w
"b	x"	q	a	d	g	j	m	p	t	w
"b	y"	q	a	d	g	j	m	p	t	w
"b	z"	q	a	d	g	j	m	p	t	w
"b	"	q	a	d	g	j	m	p	t	w
"c	a"	q	b	d	g	l	n	r	t	w
"c	b"	q	a	e	g	j	m	p	t	w
"c	c"	q	a	e	i	j	o	s	t	w
"c	d"	q	a	d	g	j	m	p	t	w
"c	e"	q	a	d	i	l	n	s	t	w
"c	f"	q	a	d	i	j	m	p	t	w
"c	g"	q	a	d	i	j	m	p	t	w
"c	h"	q	a	e	i	j	o	r	t	w
"c	i"	q	a	f	i	l	n	p	t	w
"c	j"	q	a	d	g	j	m	p	t	w
"c	k"	q	b	e	i	l	m	s	t	y
"c	l"	q	a	e	i	j	o	r	u	w
"c	m"	q	c	d	g	j	m	p	t	w
"c	n"	q	a	d	g	j	m	p	t	w
"c	o"	q	a	d	g	l	m	r	u	w
"c	p"	q	a	d	g	j	m	p	t	w
"c	q"	q	a	d	g	j	m	p	t	w
"c	r"	q	a	e	i	j	o	p	u	y
"c	s"	q	a	d	i	l	o	s	t	w
"c	t"	q	a	e	i	l	o	r	u	w

FIG. 10B

"-	-"	1	2	3	4	5	6	7	8	9
"c	u"	q	b	e	i	l	m	s	t	w
"c	v"	q	a	d	g	j	m	p	t	w
"c	w"	q	a	d	g	j	m	p	t	w
"c	x"	q	a	d	g	j	m	p	t	w
"c	y"	q	c	d	g	j	m	p	t	w
"c	z"	q	a	d	g	j	n	p	t	w
"c	"	q	a	d	g	j	m	p	t	w
"d	a"	q	b	d	g	j	n	r	t	y
"d	b"	q	a	d	g	j	m	p	t	w
"d	c"	q	a	d	g	j	m	p	t	w
"d	d"	q	a	e	i	l	m	r	t	w
"d	e"	q	a	d	g	l	m	r	v	x
"d	f"	q	a	d	i	j	m	p	t	w
"d	g"	q	a	e	g	j	m	p	t	w
"d	h"	q	a	e	g	j	m	p	t	w
"d	i"	z	a	f	g	l	n	s	t	w
"d	j"	q	a	d	g	j	m	p	t	w
"d	k"	q	a	d	g	j	m	p	t	w
"d	l"	q	a	e	i	j	m	p	t	y
"d	m"	q	a	d	i	j	m	s	t	w
"d	n"	q	a	e	g	j	m	p	t	w
"d	o"	q	c	e	i	j	n	p	t	w
"d	p"	q	a	d	g	j	m	p	t	w
"d	q"	q	a	d	g	j	m	p	u	w
"d	r"	q	a	e	i	j	o	p	t	w
"d	s"	q	a	e	i	j	m	p	t	w
"d	t"	q	a	d	g	j	m	r	t	w
"d	u"	q	c	e	g	l	m	r	t	w
"d	v"	q	a	d	i	j	m	p	t	w
"d	w"	q	a	d	i	j	o	p	t	w
"d	x"	q	a	d	g	j	m	p	t	w
"d	y"	q	a	d	g	j	m	p	t	w
"d	z"	q	a	d	g	j	m	p	t	w
"d	"	q	a	d	g	j	m	p	t	w
"e	a"	q	c	d	g	l	n	s	t	w
"e	b"	q	c	f	g	j	m	r	t	y
"e	c"	q	a	e	h	k	o	s	t	w

FIG. 10C

"-	-"	1	2	3	4	5	6	7	8	9
"e	d"	q	b	e	i	l	n	s	u	w
"e	e"	z	a	d	i	k	n	r	t	w
"e	f"	q	a	e	i	l	o	r	t	w
"e	g"	q	a	d	i	j	o	r	u	y
"e	h"	q	a	e	i	j	m	p	t	w
"e	i"	q	a	d	g	j	n	r	v	w
"e	j"	q	a	e	g	j	m	p	t	w
"e	k"	q	a	e	i	j	m	s	t	w
"e	l"	q	a	e	i	l	o	p	v	y
"e	m"	q	a	e	i	j	o	s	u	w
"e	n"	q	c	d	g	l	o	s	t	w
"e	o"	q	a	f	g	j	n	p	u	w
"e	p"	q	a	e	h	l	o	r	t	w
"e	q"	q	a	d	g	j	m	p	u	w
"e	r"	q	a	e	i	l	n	s	v	y
"e	s"	q	c	e	i	k	n	s	t	w
"e	t"	z	c	e	i	j	m	s	t	w
"e	u"	q	a	d	g	j	m	r	t	w
"e	v"	q	a	e	i	j	o	p	t	w
"e	w"	q	a	e	h	j	o	s	t	w
"e	x"	q	a	e	i	j	m	p	t	w
"e	y"	q	a	d	g	j	o	s	t	w
"e	z"	q	a	e	g	j	m	p	t	w
"e	"	q	a	d	g	j	m	p	t	w
"f	a"	q	c	d	i	k	m	s	v	x
"f	b"	q	a	d	g	j	m	p	t	w
"f	c"	q	c	d	g	j	m	p	t	w
"f	d"	q	a	d	g	j	m	p	t	w
"f	e"	q	a	e	g	l	m	r	t	w
"f	f"	q	a	e	i	j	o	s	t	w
"f	g"	q	a	d	g	j	m	p	t	w
"f	h"	q	a	d	g	j	m	p	t	w
"f	i"	q	c	e	g	l	n	r	t	x
"f	j"	q	a	d	g	j	m	p	t	w
"f	k"	q	a	d	g	j	m	p	t	w
"f	l"	q	a	e	i	j	o	p	t	y
"f	m"	q	a	d	g	j	m	p	t	w

FIG. 10D

"-	-"	1	2	3	4	5	6	7	8	9
"f	n"	q	a	d	g	j	m	p	t	w
"f	o"	q	c	d	g	l	n	r	u	w
"f	p"	q	a	d	g	j	m	p	t	w
"f	q"	q	a	d	g	j	m	p	t	w
"f	r"	q	a	e	i	j	o	p	t	y
"f	s"	q	a	d	g	j	m	p	t	w
"f	t"	q	a	e	g	k	m	p	t	w
"f	u"	q	a	d	g	l	n	r	t	w
"f	v"	q	a	d	g	j	m	p	t	w
"f	w"	q	a	d	g	j	m	p	t	w
"f	x"	q	a	d	g	j	m	p	t	w
"f	y"	q	a	d	i	j	m	p	t	w
"f	z"	q	a	d	g	j	m	p	t	w
"f	"	q	a	d	g	j	m	p	t	w
"g	a"	z	a	d	i	l	n	r	t	w
"g	b"	q	a	d	g	j	m	p	t	w
"g	c"	q	a	d	g	j	m	s	t	w
"g	d"	q	a	d	g	j	o	p	t	w
"g	e"	q	a	d	g	l	n	s	t	w
"g	f"	q	a	d	g	j	m	p	u	w
"g	g"	q	a	e	g	l	m	p	t	w
"g	h"	q	a	e	g	j	o	p	t	w
"g	i"	q	c	f	g	j	n	s	v	w
"g	j"	q	a	d	g	j	m	p	t	w
"g	k"	q	a	d	g	j	m	p	t	w
"g	l"	q	a	e	i	j	o	p	t	y
"g	m"	q	a	d	g	l	m	s	t	w
"g	n"	q	a	e	i	j	o	p	t	w
"g	o"	q	a	e	i	j	o	p	t	w
"g	p"	q	a	d	g	j	m	p	t	w
"g	q"	q	a	d	g	j	m	p	t	w
"g	r"	q	a	e	g	j	o	p	t	w
"g	s"	q	a	d	g	j	m	p	t	w
"g	t"	q	a	e	h	j	o	p	t	w
"g	u"	q	a	e	i	l	m	r	t	y
"g	v"	q	a	d	g	j	m	p	t	w
"g	w"	q	a	d	g	j	m	p	t	w

FIG. 10E

"-	-"	1	2	3	4	5	6	7	8	9
"g	x"	q	a	d	g	j	m	p	t	w
"g	y"	q	a	d	g	j	m	p	t	w
"g	z"	q	a	d	g	j	m	p	t	w
"g	"	q	a	d	g	j	m	p	t	w
"h	a"	q	b	d	i	l	n	s	t	w
"h	b"	q	a	d	g	j	m	p	t	w
"h	c"	q	a	d	g	j	o	p	t	w
"h	d"	q	a	d	g	j	m	r	t	w
"h	e"	q	c	d	i	l	n	r	t	y
"h	f"	q	a	d	g	j	m	p	t	w
"h	g"	q	a	d	g	j	m	p	t	w
"h	h"	q	a	d	g	j	m	p	t	w
"h	i"	q	c	e	g	l	n	s	t	w
"h	j"	q	a	d	g	j	m	p	t	w
"h	k"	q	a	d	g	j	m	p	t	w
"h	l"	q	a	d	g	j	m	p	t	y
"h	m"	q	a	e	g	j	m	p	t	w
"h	n"	q	a	d	i	j	o	p	t	w
"h	o"	q	b	d	i	l	n	r	u	w
"h	p"	q	a	d	g	j	m	p	u	w
"h	q"	q	a	d	g	j	m	p	t	w
"h	r"	q	a	e	i	j	o	p	t	w
"h	s"	q	a	d	g	j	m	p	t	w
"h	t"	q	a	d	g	l	m	s	t	w
"h	u"	q	a	d	g	l	m	r	t	w
"h	v"	q	a	d	g	j	m	p	t	w
"h	w"	q	a	d	g	j	m	p	t	w
"h	x"	q	a	d	g	j	m	p	t	w
"h	y"	q	a	d	g	j	m	p	t	w
"h	z"	q	a	d	g	j	m	p	t	w
"h	"	q	a	d	g	j	m	p	t	w
"i	a"	q	b	d	g	l	n	r	t	w
"i	b"	q	a	e	i	l	m	r	u	w
"i	c"	q	a	e	h	k	o	r	t	y
"i	d"	q	a	e	i	l	n	p	u	w
"i	e"	q	c	d	g	l	n	r	v	w
"i	f"	q	a	f	i	j	o	p	t	y

FIG. 10F

"-	-"	1	2	3	4	5	6	7	8	9
"i	g"	q	a	e	h	j	n	r	u	w
"i	h"	q	a	d	g	j	m	p	t	w
"i	i"	q	a	d	g	j	m	p	t	w
"i	j"	q	a	d	g	j	o	p	t	w
"i	k"	q	a	e	g	k	m	p	t	w
"i	l"	q	a	e	i	l	o	s	t	y
"i	m"	q	a	e	i	j	m	p	u	w
"i	n"	q	c	e	g	k	n	s	t	w
"i	o"	q	a	d	g	l	n	r	u	w
"i	p"	q	a	d	i	l	m	s	t	w
"i	q"	q	a	d	g	j	m	p	u	w
"i	r"	q	c	e	i	l	n	s	t	w
"i	s"	q	c	e	h	k	n	s	t	w
"i	t"	q	a	e	h	l	o	s	t	y
"i	u"	q	a	d	g	j	m	p	t	w
"i	v"	q	a	e	i	j	m	p	t	w
"i	w"	q	a	d	g	j	m	p	t	w
"i	x"	q	a	e	g	j	m	p	t	w
"i	y"	q	a	d	g	j	m	p	t	w
"i	z"	q	a	e	i	j	o	p	t	w
"i	"	q	a	d	g	j	m	p	t	w
"j	a"	q	c	d	g	j	n	p	t	w
"j	b"	q	a	d	g	j	m	p	t	w
"j	c"	q	a	d	g	j	m	p	t	w
"j	d"	q	a	d	g	j	m	p	t	w
"j	e"	q	c	d	g	j	m	r	t	w
"j	f"	q	a	d	g	j	m	p	t	w
"j	g"	q	a	d	g	j	m	p	t	w
"j	h"	q	a	d	g	j	m	p	t	w
"j	i"	q	a	d	g	j	m	p	t	w
"j	j"	q	a	d	g	j	m	p	t	w
"j	k"	q	a	d	g	j	m	p	t	w
"j	l"	q	a	d	g	j	m	p	t	w
"j	m"	q	a	d	g	j	m	p	t	w
"j	n"	q	a	d	g	j	m	p	t	w
"j	o"	q	b	e	i	j	m	r	t	w
"j	p"	q	a	d	g	j	m	p	t	w

FIG. 10G

"-	-"	1	2	3	4	5	6	7	8	9
"j	q"	q	a	d	g	j	m	p	t	w
"j	r"	q	a	d	g	j	m	p	t	w
"j	s"	q	a	d	g	j	m	p	t	w
"j	t"	q	a	d	g	j	m	p	t	w
"j	u"	q	a	d	g	l	m	s	t	w
"j	v"	q	a	d	g	j	m	p	t	w
"j	w"	q	a	d	g	j	m	p	t	w
"j	x"	q	a	d	g	j	m	p	t	w
"j	y"	q	a	d	g	j	m	p	t	w
"j	z"	q	a	d	g	j	m	p	t	w
"j	"	q	a	d	g	j	m	p	t	w
"k	a"	q	a	d	g	j	n	s	t	y
"k	b"	q	a	d	g	j	o	p	t	w
"k	c"	q	a	d	g	j	m	p	t	w
"k	d"	q	a	d	g	j	o	p	t	w
"k	e"	q	a	d	g	l	n	s	t	y
"k	f"	q	a	d	g	j	m	p	t	w
"k	g"	q	a	d	g	j	m	r	t	w
"k	h"	q	a	d	g	j	m	p	t	w
"k	i"	q	a	d	g	l	n	p	t	w
"k	j"	q	a	d	g	j	m	p	t	w
"k	k"	q	a	d	g	j	o	p	t	w
"k	l"	q	a	d	i	j	m	p	t	y
"k	m"	q	a	d	g	j	m	p	t	w
"k	n"	q	a	d	g	j	o	p	t	w
"k	o"	q	a	d	g	l	n	p	t	w
"k	p"	q	a	d	g	j	m	p	t	w
"k	q"	q	a	d	g	j	m	p	t	w
"k	r"	q	a	d	g	j	m	p	t	w
"k	s"	q	a	d	g	j	m	p	t	w
"k	t"	q	a	d	g	j	m	p	t	w
"k	u"	q	a	d	g	j	m	p	t	w
"k	v"	q	a	d	g	j	m	p	t	w
"k	w"	q	a	d	g	j	m	p	t	w
"k	x"	q	a	d	g	j	m	p	t	w
"k	y"	q	a	d	g	j	m	p	t	w
"k	z"	q	a	d	g	j	m	p	t	w

FIG. 10H

"-	-"	1	2	3	4	5	6	7	8	9
"k	"	q	a	d	g	j	m	p	t	w
"l	a"	q	b	d	i	j	n	r	t	y
"l	b"	q	a	d	g	j	o	p	t	w
"l	c"	q	a	d	g	j	o	p	t	w
"l	d"	q	a	e	i	j	n	s	t	w
"l	e"	q	a	d	g	l	m	s	t	x
"l	f"	q	a	d	g	j	m	p	t	w
"l	g"	q	a	d	g	j	m	p	t	w
"l	h"	q	a	d	g	j	m	p	t	w
"l	i"	z	c	e	g	k	n	s	t	w
"l	j"	q	a	d	g	j	m	p	t	w
"l	k"	q	a	e	i	j	m	s	t	w
"l	l"	q	c	e	i	j	o	s	u	y
"l	m"	q	a	d	g	j	o	s	t	w
"l	n"	q	a	e	g	j	m	p	t	w
"l	o"	q	c	d	g	j	o	s	t	w
"l	p"	q	a	d	h	j	m	s	t	w
"l	q"	q	a	d	g	j	m	p	t	w
"l	r"	q	a	e	g	j	m	p	t	w
"l	s"	q	a	e	i	j	o	p	t	w
"l	t"	q	a	e	i	j	o	s	t	w
"l	u"	q	c	d	g	l	m	s	t	w
"l	v"	q	a	e	i	j	m	p	t	w
"l	w"	q	a	e	g	j	m	p	t	w
"l	x"	q	a	d	g	j	m	p	t	w
"l	y"	z	a	d	i	j	n	s	t	w
"l	z"	q	a	d	g	j	m	p	t	w
"l	"	q	a	d	g	j	m	p	t	w
"m	a"	q	c	d	i	k	n	r	t	y
"m	b"	q	a	e	i	l	m	p	t	y
"m	c"	q	c	d	i	j	o	p	t	w
"m	d"	q	a	d	g	j	m	p	t	w
"m	e"	q	a	e	g	l	n	s	t	w
"m	f"	q	a	d	g	j	o	p	t	w
"m	g"	q	a	d	g	j	m	p	t	w
"m	h"	z	a	d	g	j	m	p	t	w
"m	i"	z	c	d	g	l	n	s	t	x

FIG. 10I

"-	-"	1	2	3	4	5	6	7	8	9
"m	j"	q	a	d	g	j	m	p	t	w
"m	k"	q	a	d	g	j	m	p	t	w
"m	l"	q	a	e	g	j	m	p	t	y
"m	m"	q	a	e	i	j	o	p	u	w
"m	n"	q	a	d	g	j	m	p	t	w
"m	o"	q	b	d	i	j	n	r	v	w
"m	p"	q	a	e	i	l	o	r	t	w
"m	q"	q	a	d	g	j	m	p	t	w
"m	r"	q	a	d	g	j	m	p	t	w
"m	s"	q	a	e	g	j	m	p	t	w
"m	t"	q	a	d	g	j	m	p	t	w
"m	u"	q	c	d	g	l	n	s	t	w
"m	v"	q	a	d	g	j	m	p	t	w
"m	w"	q	a	d	h	j	m	p	t	w
"m	x"	q	a	d	g	j	m	p	t	w
"m	y"	q	c	d	g	j	m	s	t	w
"m	z"	q	a	d	g	j	m	p	t	w
"m	"	q	a	d	g	j	m	p	t	w
"n	a"	q	b	d	g	l	m	r	t	w
"n	b"	q	a	d	g	j	m	p	t	w
"n	c"	q	a	e	i	l	o	r	t	y
"n	d"	q	a	e	i	l	o	s	t	y
"n	e"	q	c	e	i	l	n	s	t	w
"n	f"	q	a	e	i	j	o	s	u	w
"n	g"	q	a	e	i	l	m	s	u	w
"n	h"	q	a	d	g	j	m	p	t	w
"n	i"	z	c	e	g	l	n	s	t	x
"n	j"	q	a	d	g	j	m	p	u	w
"n	k"	q	a	e	i	j	n	s	t	w
"n	l"	q	a	e	i	j	o	p	t	y
"n	m"	q	a	e	g	j	m	p	t	w
"n	n"	q	a	e	i	j	o	p	u	y
"n	o"	q	b	d	g	l	n	r	t	w
"n	p"	q	a	d	g	j	o	p	u	w
"n	q"	q	a	d	g	j	m	p	u	w
"n	r"	q	a	d	g	j	m	p	t	w
"n	s"	q	a	e	i	l	m	p	t	w

FIG. 10J

"-	-"	1	2	3	4	5	6	7	8	9
"n	t"	q	a	e	i	l	o	s	u	y
"n	u"	q	a	f	g	j	m	s	t	x
"n	v"	q	a	e	i	j	o	p	t	w
"n	w"	q	a	e	g	j	m	p	t	w
"n	x"	q	a	d	g	j	m	p	t	w
"n	y"	q	b	d	h	j	m	p	t	w
"n	z"	q	a	d	g	j	m	p	t	w
"n	"	q	a	d	g	j	m	p	t	w
"o	a"	q	b	d	g	l	m	s	t	w
"o	b"	q	a	e	i	l	o	s	t	w
"o	c"	q	a	e	h	k	o	s	u	w
"o	d"	q	a	e	i	l	o	s	u	y
"o	e"	q	a	d	g	j	m	s	t	w
"o	f"	q	a	f	g	j	m	p	t	w
"o	g"	q	a	e	i	j	o	r	t	y
"o	h"	q	a	d	g	j	n	p	t	w
"o	i"	q	c	d	g	l	n	p	t	w
"o	j"	q	a	e	g	j	m	p	t	w
"o	k"	q	a	e	i	j	m	s	t	w
"o	l"	q	b	d	i	l	o	s	u	w
"o	m"	q	a	e	i	l	m	p	t	w
"o	n"	q	a	e	g	l	n	s	t	y
"o	o"	q	a	d	g	k	n	s	t	w
"o	p"	q	a	e	h	l	m	p	t	y
"o	q"	q	a	d	g	j	m	p	t	w
"o	r"	q	a	e	g	k	m	r	t	w
"o	s"	q	c	e	i	j	o	s	t	y
"o	t"	q	a	e	h	j	o	s	t	y
"o	u"	q	c	d	g	l	n	r	t	y
"o	v"	q	a	e	i	j	m	p	t	w
"o	w"	q	a	e	i	j	n	s	t	w
"o	x"	q	a	d	i	j	m	p	t	w
"o	y"	q	a	e	g	j	m	s	t	w
"o	z"	q	a	d	g	j	m	p	t	w
"o	"	q	a	d	g	j	m	p	t	w
"p	a"	q	c	d	g	l	n	r	t	y
"p	b"	q	a	e	g	j	m	p	t	w

FIG. 10K

"-	-"	1	2	3	4	5	6	7	8	9
"p	c"	q	a	d	g	j	m	s	t	w
"p	d"	q	a	d	g	j	m	p	t	w
"p	e"	q	c	d	g	j	n	r	t	w
"p	f"	q	a	d	g	j	m	r	t	w
"p	g"	q	a	d	g	j	m	p	t	w
"p	h"	q	a	e	i	j	o	s	t	y
"p	i"	q	c	d	g	l	n	r	t	x
"p	j"	q	a	d	g	j	m	p	t	w
"p	k"	q	a	d	g	j	m	p	t	w
"p	l"	q	a	e	i	j	o	p	u	y
"p	m"	q	a	e	g	j	m	p	t	w
"p	n"	q	a	d	g	j	m	p	t	w
"p	o"	q	c	d	i	l	n	r	t	w
"p	p"	q	a	e	i	l	o	p	t	y
"p	q"	q	a	d	g	j	m	p	t	w
"p	r"	q	a	e	i	j	o	p	t	y
"p	s"	q	a	d	g	j	m	p	t	w
"p	t"	q	c	e	i	j	o	s	t	w
"p	u"	q	b	d	g	j	m	r	t	w
"p	v"	q	a	d	g	j	m	p	t	w
"p	w"	q	a	d	g	j	m	p	t	w
"p	x"	q	a	d	g	j	m	p	t	w
"p	y"	q	a	d	g	j	m	r	t	w
"p	z"	q	a	d	g	j	m	p	t	w
"p	"	q	a	d	g	j	m	p	t	w
"q	a"	q	a	d	g	j	m	p	t	w
"q	b"	q	a	d	g	j	m	p	t	w
"q	c"	q	a	d	g	j	m	p	t	w
"q	d"	q	a	d	g	j	m	p	t	w
"q	e"	q	a	d	g	j	m	p	t	w
"q	f"	q	a	d	g	j	m	p	t	w
"q	g"	q	a	d	g	j	m	p	t	w
"q	h"	q	a	d	g	j	m	p	t	w
"q	i"	q	a	d	g	j	m	p	t	w
"q	j"	q	a	d	g	j	m	p	t	w
"q	k"	q	a	d	g	j	m	p	t	w
"q	l"	q	a	d	g	j	m	p	t	w

FIG. 10L

"-	-"	1	2	3	4	5	6	7	8	9
"q	m"	q	a	d	g	j	m	p	t	w
"q	n"	q	a	d	g	j	m	p	t	w
"q	o"	q	a	d	g	j	m	p	t	w
"q	p"	q	a	d	g	j	m	p	t	w
"q	q"	q	a	d	g	j	m	p	t	w
"q	r"	q	a	d	g	j	m	p	t	w
"q	s"	q	a	d	g	j	m	p	t	w
"q	t"	q	a	d	g	j	m	p	t	w
"q	u"	q	a	e	i	j	o	p	t	w
"q	v"	q	a	d	g	j	m	p	t	w
"q	w"	q	a	d	g	j	m	p	t	w
"q	x"	q	a	d	g	j	m	p	t	w
"q	y"	q	a	d	g	j	m	p	t	w
"q	z"	q	a	d	g	j	m	p	t	w
"q	"	q	a	d	g	j	m	p	t	w
"r	a"	q	c	d	g	l	n	p	t	w
"r	b"	q	a	d	g	j	o	p	t	w
"r	c"	q	a	e	h	l	m	p	u	w
"r	d"	q	a	e	i	j	n	s	v	w
"r	e"	q	a	e	g	l	n	s	v	w
"r	f"	q	a	e	g	j	o	p	t	w
"r	g"	q	a	e	i	j	m	s	u	w
"r	h"	q	a	e	g	j	o	p	t	w
"r	i"	z	c	e	g	l	n	p	t	w
"r	j"	q	a	d	g	j	m	p	t	w
"r	k"	q	a	e	i	l	m	s	t	y
"r	l"	q	a	d	i	j	o	p	t	y
"r	m"	q	a	e	i	j	m	s	t	w
"r	n"	q	a	e	i	j	o	s	t	w
"r	o"	q	b	d	g	l	m	p	u	w
"r	p"	q	a	d	g	j	o	r	t	w
"r	q"	q	a	d	g	j	m	p	t	w
"r	r"	q	a	e	i	j	o	p	t	y
"r	s"	q	a	e	i	j	o	p	t	w
"r	t"	z	a	e	h	j	n	s	u	w
"r	u"	q	c	e	g	l	n	s	t	w
"r	v"	q	a	e	i	j	m	p	t	w

FIG. 10M

"-	-"	1	2	3	4	5	6	7	8	9
"r	w"	q	a	d	i	j	o	p	t	w
"r	x"	q	a	d	g	j	m	p	t	w
"r	y"	q	b	d	i	j	m	p	t	w
"r	z"	q	a	d	g	j	m	p	t	w
"r	"	q	a	d	g	j	m	p	t	w
"s	a"	q	b	d	g	l	m	p	v	y
"s	b"	q	a	d	g	j	m	p	t	w
"s	c"	q	a	d	h	l	o	r	u	w
"s	d"	q	a	d	g	j	n	p	t	w
"s	e"	q	c	e	g	l	n	r	t	y
"s	f"	q	a	e	g	j	m	p	u	w
"s	g"	q	a	d	g	j	m	r	t	w
"s	h"	q	a	e	i	l	o	r	t	w
"s	i"	z	c	d	g	l	n	s	t	x
"s	j"	q	a	d	g	j	m	p	t	w
"s	k"	q	a	e	i	j	m	p	t	w
"s	l"	q	a	e	i	j	o	p	t	y
"s	m"	q	a	e	i	j	o	s	t	w
"s	n"	q	a	e	g	j	m	p	t	w
"s	o"	q	c	f	g	l	m	r	u	w
"s	p"	q	a	e	g	l	o	r	t	w
"s	q"	q	a	d	g	l	m	p	u	w
"s	r"	q	c	d	g	j	m	p	t	w
"s	s"	q	a	e	i	j	o	p	u	w
"s	t"	q	a	e	i	l	o	r	u	y
"s	u"	q	b	e	g	l	m	p	t	w
"s	v"	q	a	d	g	j	m	p	t	w
"s	w"	q	a	e	i	j	o	p	t	w
"s	x"	q	a	d	g	j	m	p	t	w
"s	y"	q	a	d	g	j	m	s	t	w
"s	z"	q	a	d	g	j	m	p	t	w
"s	"	q	a	d	g	j	m	p	t	w
"t	a"	q	c	f	i	l	n	r	t	y
"t	b"	q	a	d	g	j	m	p	t	w
"t	c"	z	a	d	h	j	o	p	t	w
"t	d"	q	a	d	g	j	m	p	t	w
"t	e"	q	c	d	g	l	m	r	u	x

FIG. 10N

"-	-"	1	2	3	4	5	6	7	8	9
"t	f"	q	a	d	i	j	o	p	t	w
"t	g"	q	a	e	g	j	o	p	t	w
"t	h"	q	a	e	i	l	o	r	u	w
"t	i"	z	c	e	g	l	o	s	v	w
"t	j"	q	a	d	g	j	m	p	t	w
"t	k"	q	a	e	g	j	m	p	t	w
"t	l"	q	a	e	i	j	m	p	t	y
"t	m"	q	a	e	g	l	o	p	t	w
"t	n"	q	a	e	g	j	m	p	t	w
"t	o"	q	c	d	g	l	m	r	u	w
"t	p"	q	c	d	g	j	m	p	u	w
"t	q"	q	a	d	g	j	m	p	t	w
"t	r"	q	a	e	i	j	o	p	u	y
"t	s"	q	c	e	i	j	o	p	u	w
"t	t"	q	a	e	i	l	o	p	t	y
"t	u"	q	a	f	i	j	n	r	t	w
"t	v"	q	a	d	g	j	m	p	t	w
"t	w"	q	a	e	i	j	o	p	t	w
"t	x"	q	a	d	g	j	m	p	t	w
"t	y"	q	a	d	g	l	m	p	t	w
"t	z"	q	a	d	g	j	m	p	t	w
"t	"	q	a	d	g	j	m	p	t	w
"u	a"	q	a	d	g	l	n	r	t	w
"u	b"	q	a	e	i	j	m	s	t	w
"u	c"	q	c	e	h	k	m	p	t	w
"u	d"	q	a	e	i	j	o	p	t	y
"u	e"	q	a	d	g	j	n	s	t	w
"u	f"	q	a	f	g	j	m	p	t	w
"u	g"	q	a	e	h	j	m	s	t	w
"u	h"	q	a	d	g	j	m	p	t	w
"u	i"	q	c	d	g	l	n	r	t	w
"u	j"	q	a	d	g	j	m	p	t	w
"u	k"	q	a	d	g	j	m	p	t	w
"u	l"	q	a	d	g	l	m	p	t	y
"u	m"	q	b	e	i	j	m	p	t	w
"u	n"	q	c	d	i	l	n	s	t	w
"u	o"	q	a	d	g	j	m	p	t	w

FIG. 100

"-	-"	1	2	3	4	5	6	7	8	9
"u	p"	q	a	d	i	l	o	p	t	y
"u	q"	q	a	d	g	j	m	p	t	w
"u	r"	q	c	e	i	l	n	s	t	y
"u	s"	q	a	e	i	l	m	s	t	y
"u	t"	q	a	e	i	l	o	s	t	w
"u	u"	q	c	d	g	j	m	p	t	w
"u	v"	q	a	d	g	j	m	p	t	w
"u	w"	q	a	d	g	j	m	p	t	w
"u	x"	q	a	d	g	j	m	p	t	w
"u	y"	q	a	e	g	j	m	s	t	w
"u	z"	q	a	d	g	j	m	p	t	w
"u	"	q	a	d	g	j	m	p	t	w
"v	a"	q	c	d	i	l	n	r	t	w
"v	b"	q	a	d	g	j	m	p	t	w
"v	c"	q	a	d	g	j	m	s	t	w
"v	d"	q	a	d	g	j	m	p	t	w
"v	e"	q	a	d	g	l	n	r	t	w
"v	f"	q	a	d	g	j	m	p	t	w
"v	g"	q	a	d	g	j	m	p	t	w
"v	h"	q	a	d	g	j	m	p	t	w
"v	i"	q	c	e	g	j	n	s	t	w
"v	j"	q	a	d	g	j	m	p	t	w
"v	k"	q	a	d	g	j	m	p	t	w
"v	l"	q	a	d	g	j	m	s	t	w
"v	m"	q	a	d	g	j	m	p	t	w
"v	n"	q	a	d	g	j	m	p	t	w
"v	o"	q	a	d	i	l	o	r	t	w
"v	p"	q	a	d	g	j	m	p	t	w
"v	q"	q	a	d	g	j	m	p	t	w
"v	r"	q	a	d	g	j	m	p	t	w
"v	s"	q	a	d	g	j	m	p	t	w
"v	t"	q	a	d	g	j	m	p	t	w
"v	u"	q	a	d	g	j	m	p	t	w
"v	v"	q	a	d	g	j	m	p	t	w
"v	w"	q	a	d	g	j	m	p	t	w
"v	x"	q	a	d	g	j	m	p	t	w
"v	y"	q	a	d	g	j	m	p	t	w

FIG. 10P

"-	-"	1	2	3	4	5	6	7	8	9
"v	z"	q	a	d	g	j	m	p	t	w
"v	"	q	a	d	g	j	m	p	t	w
"w	a"	q	b	d	i	l	n	r	v	y
"w	b"	q	a	d	g	j	m	p	t	w
"w	c"	q	a	e	g	j	m	p	t	w
"w	d"	q	a	f	g	j	m	p	t	w
"w	e"	q	b	e	i	l	n	r	v	w
"w	f"	q	a	d	g	j	m	p	t	w
"w	g"	q	a	d	g	j	m	p	t	w
"w	h"	q	a	e	i	j	o	p	t	y
"w	i"	q	c	d	g	l	n	s	t	w
"w	j"	q	a	d	g	j	m	p	t	w
"w	k"	q	a	d	g	j	m	p	t	w
"w	l"	q	a	d	g	j	m	p	t	w
"w	m"	q	a	d	g	j	m	p	t	w
"w	n"	q	a	d	g	l	m	s	t	w
"w	o"	q	a	d	g	j	n	r	u	w
"w	p"	q	a	d	h	j	m	p	t	w
"w	q"	q	a	d	g	j	m	p	t	w
"w	r"	q	a	d	i	j	o	p	t	w
"w	s"	q	a	e	g	j	m	p	t	w
"w	t"	q	a	d	g	j	m	p	t	w
"w	u"	q	a	d	g	j	m	p	t	w
"w	v"	q	a	d	g	j	m	p	t	w
"w	w"	q	a	d	g	j	m	p	t	w
"w	x"	q	a	d	g	j	m	p	t	w
"w	y"	q	a	d	g	j	m	p	t	w
"w	z"	q	a	d	g	j	m	p	t	w
"w	"	q	a	d	g	j	m	p	t	w
"x	a"	q	c	d	g	j	m	p	t	w
"x	b"	q	a	d	g	j	m	p	t	w
"x	c"	q	a	e	h	j	m	p	t	w
"x	d"	q	a	d	g	j	m	p	t	w
"x	e"	q	c	d	g	l	m	s	t	x
"x	f"	q	a	d	g	j	m	p	t	w
"x	g"	q	a	d	g	j	m	p	t	w
"x	h"	q	a	d	g	j	m	p	t	w

FIG. 10Q

"-	-"	1	2	3	4	5	6	7	8	9
"x	i"	q	c	d	g	j	n	s	t	w
"x	j"	q	a	d	g	j	m	p	t	w
"x	k"	q	a	d	g	j	m	p	t	w
"x	l"	q	a	d	i	j	m	p	t	w
"x	m"	q	a	d	g	j	m	p	t	w
"x	n"	q	a	d	g	j	m	p	t	w
"x	o"	q	a	d	g	j	m	p	t	w
"x	p"	q	a	e	i	l	o	p	t	w
"x	q"	q	a	d	g	j	m	p	t	w
"x	r"	q	a	d	g	j	m	p	t	w
"x	s"	q	a	e	i	j	m	p	t	w
"x	t"	q	a	e	g	j	m	r	u	w
"x	u"	q	a	d	g	j	m	p	t	w
"x	v"	q	a	d	g	j	m	p	t	w
"x	w"	q	a	d	g	j	m	p	t	w
"x	x"	q	a	d	g	j	m	p	t	w
"x	y"	z	a	d	g	j	m	p	t	w
"x	z"	q	a	d	g	j	m	p	t	w
"x	"	q	a	d	g	j	m	p	t	w
"y	a"	q	a	d	g	j	m	p	t	w
"y	b"	q	a	e	i	j	o	p	t	w
"y	c"	q	a	d	g	l	o	p	t	w
"y	d"	q	a	d	g	j	m	p	t	w
"y	e"	q	a	e	g	j	m	s	t	w
"y	f"	q	a	d	g	j	m	p	t	w
"y	g"	q	a	d	g	j	m	p	t	w
"y	h"	q	a	d	g	j	o	p	t	w
"y	i"	q	c	d	g	j	n	p	t	w
"y	j"	q	a	d	g	j	m	p	t	w
"y	k"	q	a	d	g	j	m	p	t	w
"y	l"	q	a	e	g	j	m	p	t	w
"y	m"	q	a	e	g	j	o	p	t	w
"y	n"	q	c	d	g	j	m	p	t	x
"y	o"	q	a	d	g	j	n	r	u	w
"y	p"	q	a	e	i	j	m	p	t	w
"y	q"	q	a	d	g	j	m	p	t	w
"y	r"	q	a	d	i	j	m	p	t	w

FIG. 10R

"-	-"	1	2	3	4	5	6	7	8	9
"y	s"	q	c	e	i	j	m	p	t	w
"y	t"	q	a	e	h	j	m	p	t	w
"y	u"	q	a	d	g	k	m	r	t	w
"y	v"	q	a	d	g	j	m	p	t	w
"y	w"	q	a	d	h	j	m	p	t	w
"y	x"	q	a	d	g	j	m	p	t	w
"y	y"	q	a	d	g	j	m	p	t	w
"y	z"	q	a	e	g	j	m	p	t	w
"y	"	q	a	d	g	j	m	p	t	w
"z	a"	q	a	d	g	j	m	p	t	w
"z	b"	q	a	d	g	j	m	p	t	w
"z	c"	q	a	d	g	j	m	p	t	w
"z	d"	q	a	d	g	j	m	p	t	w
"z	e"	q	a	d	g	j	n	r	t	w
"z	f"	q	a	d	g	j	m	p	t	w
"z	g"	q	a	d	g	j	m	p	t	w
"z	h"	q	a	d	g	j	m	p	t	w
"z	i"	q	a	d	g	j	n	p	t	w
"z	j"	q	a	d	g	j	m	p	t	w
"z	k"	q	a	d	g	j	m	p	t	w
"z	l"	q	a	d	g	j	m	p	t	w
"z	m"	q	a	d	g	j	m	p	t	w
"z	n"	q	a	e	g	j	m	p	t	w
"z	o"	q	a	d	g	j	n	p	t	w
"z	p"	q	a	d	g	j	m	p	t	w
"z	q"	q	a	d	g	j	m	p	t	w
"z	r"	q	a	d	g	j	m	p	t	w
"z	s"	q	a	d	g	j	m	p	t	w
"z	t"	q	a	d	g	j	m	p	t	w
"z	u"	q	a	d	g	j	m	p	t	w
"z	v"	q	a	d	g	j	m	p	t	w
"z	w"	q	a	d	g	j	m	p	t	w
"z	x"	q	a	d	g	j	m	p	t	w
"z	y"	q	a	d	g	j	m	p	t	w
"z	z"	q	a	d	g	j	m	p	t	w
"z	"	q	a	d	g	j	m	p	t	w
"	a"	q	c	d	i	l	n	r	t	w

FIG. 10S

"-	-"	1	2	3	4	5	6	7	8	9
"	b"	q	a	e	i	l	o	r	u	y
"	c"	q	a	e	h	l	o	r	u	y
"	d"	q	a	e	i	j	o	r	u	w
"	e"	q	a	d	i	l	n	s	v	x
"	f"	q	a	e	i	l	o	r	u	w
"	g"	q	a	e	i	l	o	r	u	w
"	h"	q	a	e	i	j	o	p	t	w
"	i"	q	c	f	g	j	n	s	t	w
"	j"	q	a	e	g	j	o	p	u	w
"	k"	q	b	e	i	j	n	p	t	w
"	l"	q	a	e	i	l	o	p	u	y
"	m"	q	a	e	i	k	o	s	u	y
"	n"	q	a	e	i	j	o	p	u	w
"	o"	z	b	f	g	k	n	r	u	w
"	p"	q	a	e	h	l	o	r	u	w
"	q"	z	a	d	g	j	m	p	u	w
"	r"	q	a	e	i	j	o	s	u	w
"	s"	q	c	e	h	l	o	p	t	y
"	t"	q	a	e	h	j	o	r	u	w
"	u"	q	a	d	i	k	n	s	t	w
"	v"	q	a	e	i	l	o	p	t	w
"	w"	q	a	e	i	j	o	r	t	w
"	x"	q	a	d	g	j	m	p	t	y
"	y"	q	a	e	i	j	o	p	u	w
"	z"	q	a	e	i	j	o	p	t	y
"	"	q	a	f	i	l	o	s	t	w

FIG. 10T

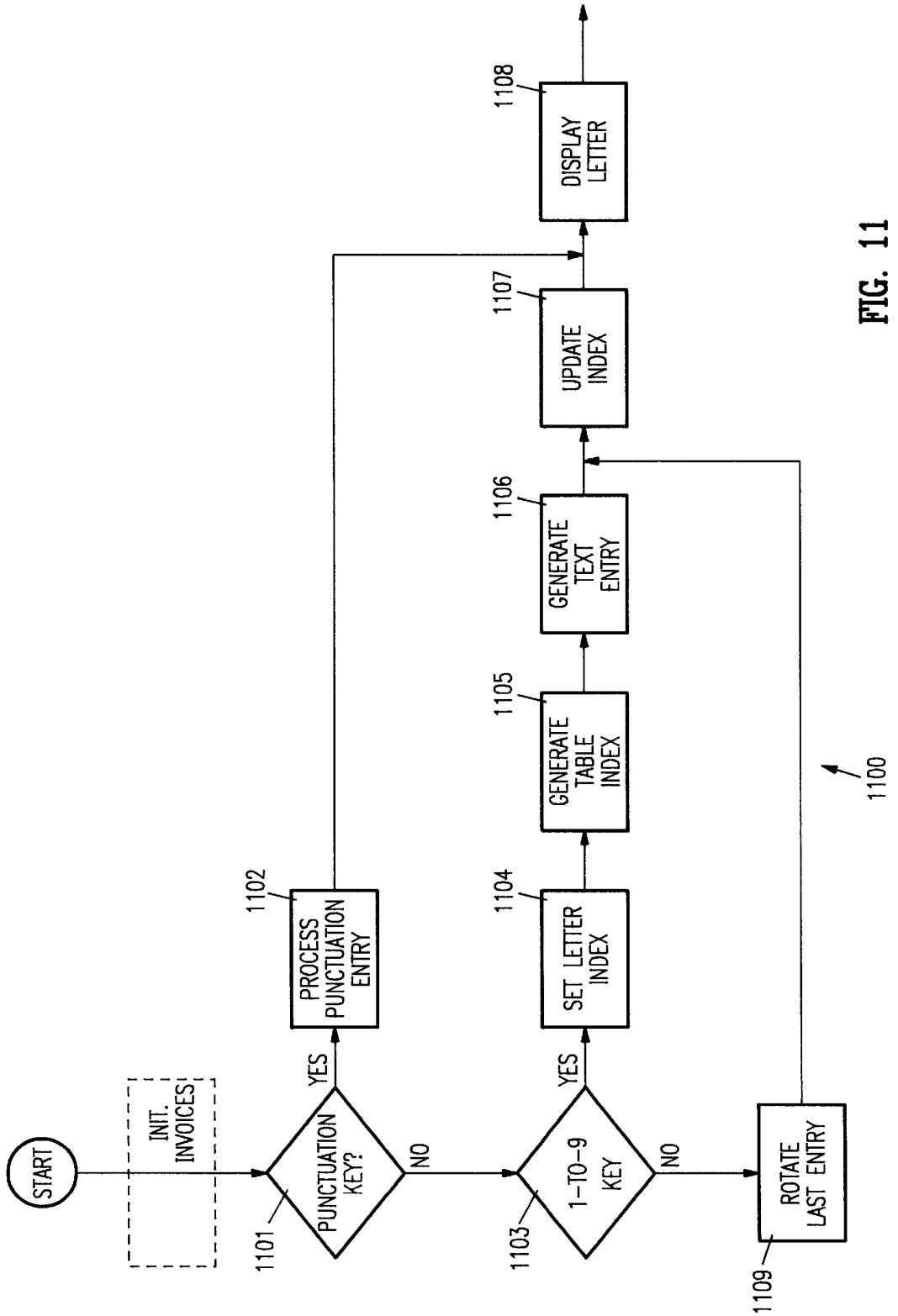


FIG. 11

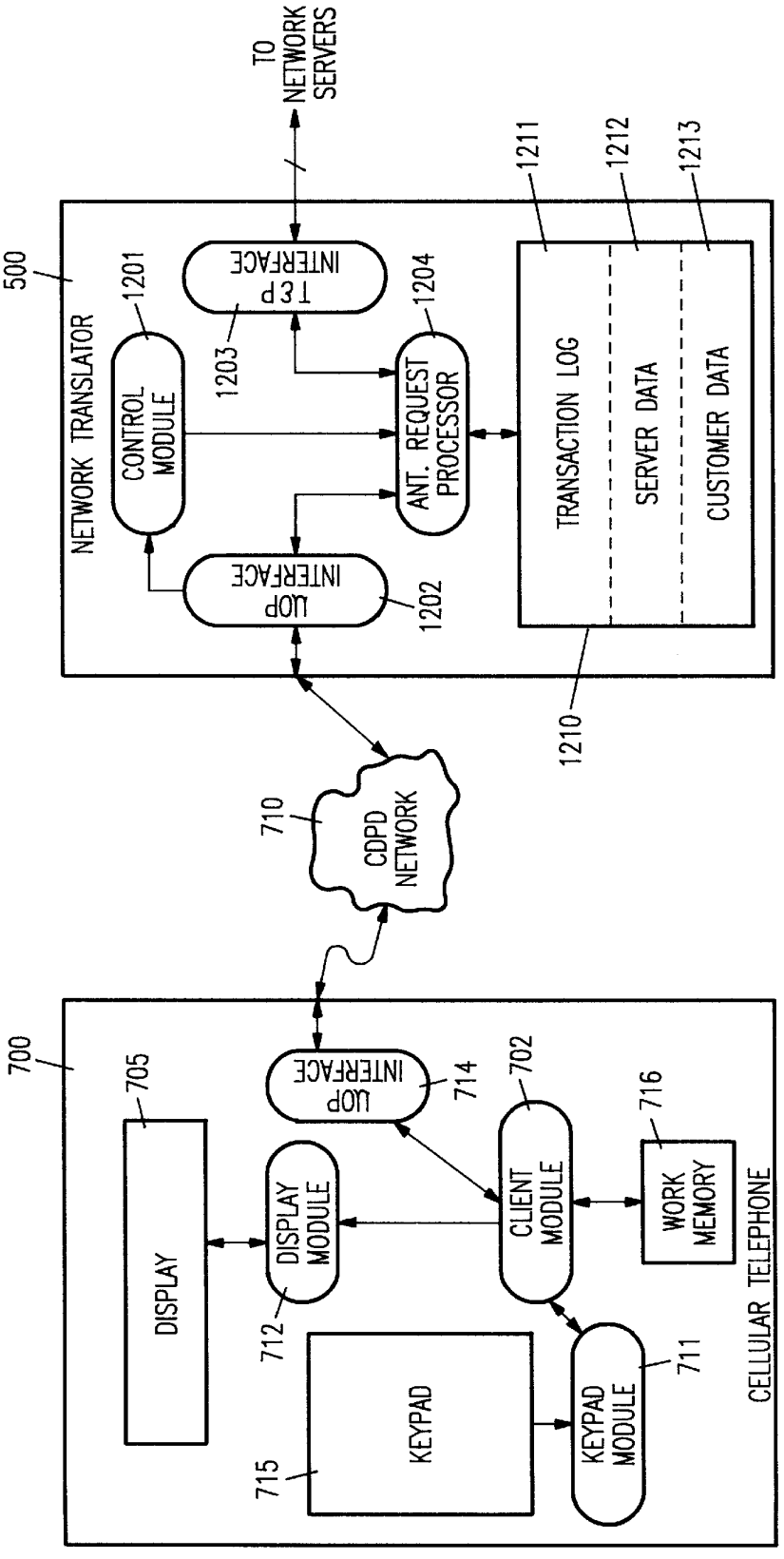


FIG. 12

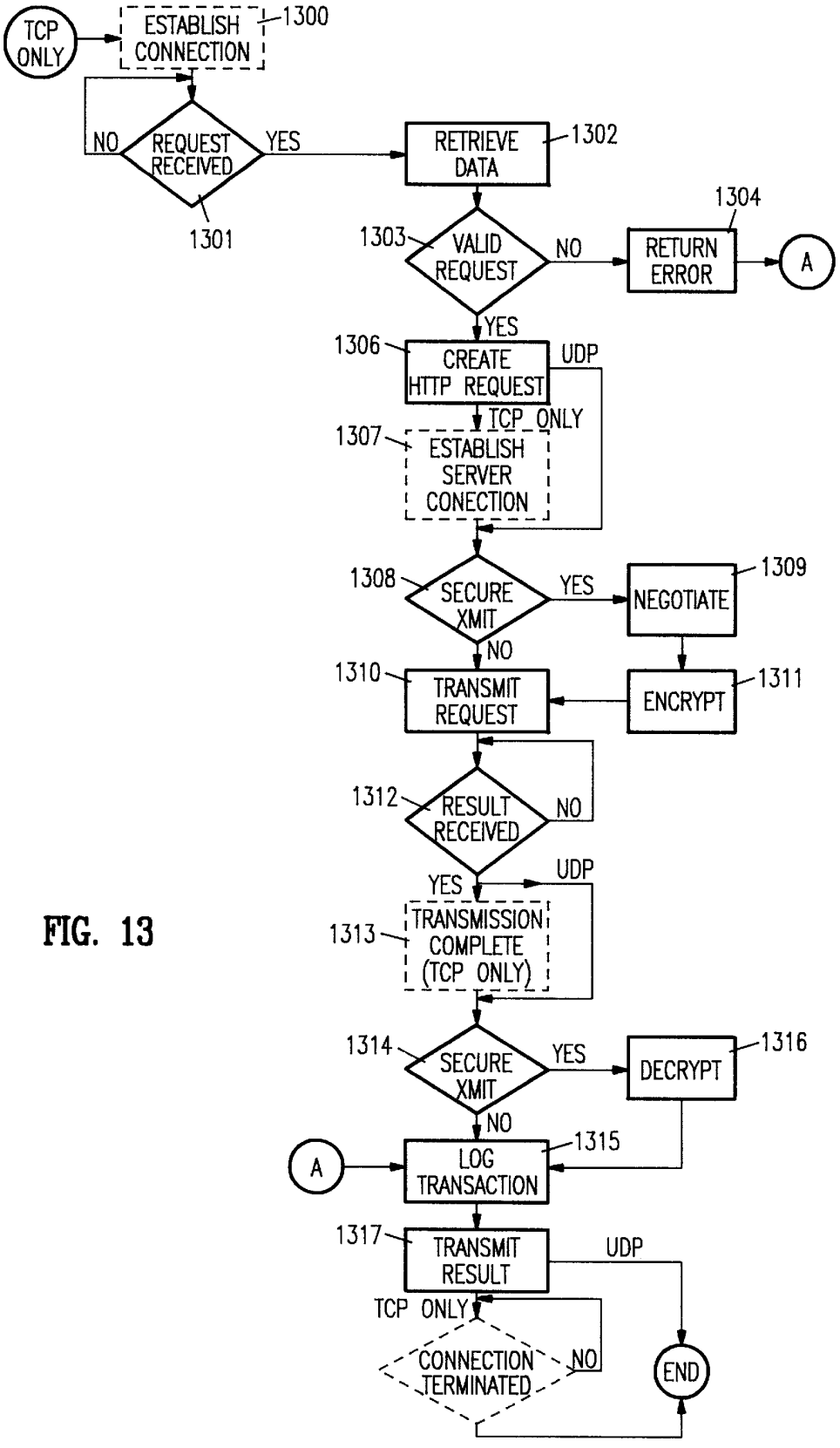


FIG. 13

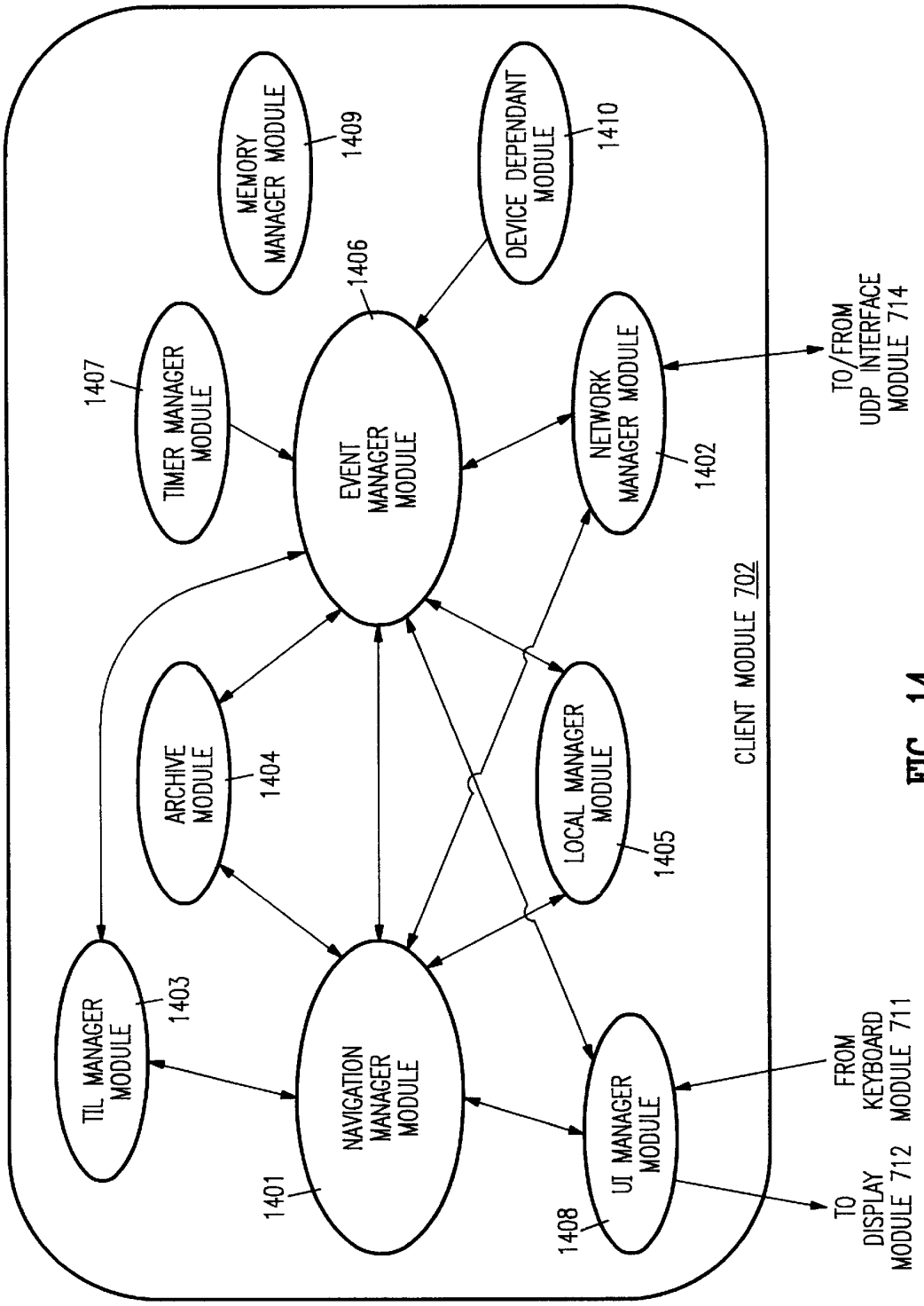


FIG. 14

METHOD AND ARCHITECTURE FOR AN INTERACTIVE TWO-WAY DATA COMMUNICATION NETWORK

CROSS REFERENCE TO MICROFICHE APPENDIX

Appendix A, which is a part of the present disclosure, is a microfiche appendix consisting of six sheets of microfiche having a total of 369 frames. Microfiche Appendix A is a listing of one embodiment of the client module of this invention, which is described more completely below, and a server, as described more completely below, to communicate and interact with the client module of this invention.

A portion of the disclosure of this patent document contains material, that includes, but is not limited to, Microfiche Appendix A, Appendix I, Appendix II, and FIGS. **10**A to **10**T, which is subject to copyright protection. The copyright owner has no objection to the facsimile reproduction by anyone of the patent document or the patent disclosure, as it appears in the Patent and Trademark Office patent files or records, but otherwise reserves all copyright rights whatsoever.

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates generally to data communications, and in particular to two-way data communication devices including a cellular telephone, a two-way pager, and a telephone that permit a user to interface with and interact with a server on a computer network.

2. Description of Related Art

For at least the last five years, the wireless communication industry has tried to merge computing with wireless communications. This industry wide effort has held the promise of bringing software intelligence to telecommunication devices including mobile wireless communications devices such as cellular telephones and two-way pagers as well as standard telephones.

After years of research and development, and hundreds of millions of dollars' investment by some of the largest companies in the field such as Motorola, AT&T, Sony, Matsushita, Phillips and IBM, the results have been nothing but disappointing. Typically, the intelligent communication devices resulting from these efforts include both the hardware necessary for a computer module and the hardware for a wireless communications module. Examples of such products are Simon from IBM and Bell South, MagicLink from Sony, and Envoy from Motorola.

Fundamental design and cost problems arising directly from the approach taken by the designers of these intelligent communication devices have limited widespread market acceptance of these devices. The combination of a wireless communication module with a computing module leads to a device that is too bulky, too expensive, and too inflexible to address the market requirements.

The combination of the two modules is too large and too heavy to fit in a user's pocket. Pocket size is a key requirement of the mobile communication market which remains unmet by these devices

In addition, the cost of these devices is close to the sum of the cost of the computer module and of the communications module, which is around a one thousand dollar end-user price. Market research indicates that the market for intelligent wireless communications devices is at prices around $300. Even with a 20% compound cost decline, it would take five years for the combination units to meet today's customers' price requirements. It is therefore unlikely that devices designed by combining a computer and a wireless module, no matter how miniaturized and cost reduced, can satisfy the cost requirement of the market during this decade.

To succeed in the market place, intelligent wireless communication devices must be able to support a wide variety of applications specific to each market segment. Typically, these applications must be added to the device by the end-user after purchase. Thus, the device must provide a method for loading the initial application and for subsequent updating of the application.

The price sensitivity for intelligent communication devices and the size limitations means that an intelligent communication device cannot support the amount of core memory (RAM), a hard disk or non-erasable memory, or a traditional floppy disk drive, commonly found on computers. These limitations close the traditional routes for delivering new applications or updates to intelligent communications devices.

As a result, the current crop of intelligent communication devices run only the few applications which were burned into their ROMs at the factory or which are contained in a ROM card plugged into a slot designed for this purpose. This scheme lacks the flexibility needed to run the thousands of applications required to address the fragmented requirements of the market and provides no simple method for updating the applications after the device has been sold.

Two other communication oriented attempts at bringing intelligence to telephones are Short Messaging Service (SMS) and Analog Display Service Interface (ADSI). SMS specifies how messages are delivered to and from a cellular telephone and how the cellular telephone should store the messages. SMS also defines some simple processing which the cellular telephone can perform on the message, such as calling a telephone number embedded in the message.

SMS's architecture is similar to that of paging networks with the difference that devices implementing the SMS architecture operate over the control channel of the cellular telephone network. SMS is deployed primarily in Europe over the GSM network.

SMS messages are not delivered in real time. The time delays can range from 30 seconds up to 10 minutes, which makes SMS unsuitable for real time applications. The main purpose of SMS is the delivery of messages. SMS does not specify an application protocol or cellular telephone application module which further restricts its usefulness in running applications on cellular telephones. After a few years of deployment in Europe, SMS implementations have been limited to notification services such as two-way paging and voice mail notification.

SMS as a medium is unsuited to building applications which allows the retrieval, manipulation, and storage of information. This is the reason why the industry giants have not turned to SMS in their quest to add intelligence to cellular telephones, but have consistently attempted to combine a computer module with a wireless communications module.

ADSI was designed as an extension to Interactive Voice Response Systems. ADSI allows a smart telephone with a small screen to display prompts to assist users in choosing among various options. By using visual prompts instead of cumbersome voice prompts, ADSI is thought to make the use of interactive voice services easier and faster.

ADSI allows data to be sent from the service provider to the telephone in the form of screens. ADSI also allows the

telephone to respond through touch tone signaling with a special coding to describe the full alphanumeric character set. With ADSI, a telephone is primarily a passive device. Services send text screens to the telephone, and the telephone sends back short strings indicating the choices the user made from the text screen.

ADSI makes no provisions for performance of processing in the telephone. As a result, ADSI generates a high traffic load on the telephone network since each user input is sent back to the service for processing. This makes ADSI unsuitable for wireless networks where bandwidth is at a premium and "air efficiency" is one of the most sought after qualities. The lack of processing capability in the telephone and the high bandwidth requirements of ADSI have prevented it from being considered by the industry for implementing intelligent wireless devices.

Up to now, intelligent communication devices have combined a computing module with a wireless communications module. However, to gain widespread acceptance, a two-way data communication device with processing capability and the ability to run a wide variety of differing user applications is needed. In addition, such a device should be comparable in size, cost, and weight to a cellular telephone.

SUMMARY OF THE INVENTION

According to the principles of this invention, the prior art limitations of combining a computer module with a wireless communication module have been overcome. In particular, a two-way data communication device of this invention, such as a cellular telephone, two-way pager, or telephone includes a client module that communicates with a server computer over a two-way data communication network. The principles of this invention can be used with a wide variety of two-way data communication networks. For example, two-way data communication networks for cellular telephones that may be used include a cellular digital packet data network as well as TDMA, CDMA, and GSM circuit switched data networks; and the AMPS analog cellular network with a modem. Similarly, for two-way pagers, two-way data communication networks include PACT, the new AT&T endorsed two way paging standard, or other priority two-way paging networks with data transport capability. The two-way data communication network for a telephone is the public switched telephone network.

Using the two-way communication device that includes the client module, a user can provide information to the server computer, retrieve information from the server computer, provide data to an application on the server computer which uses the data and provides information to the two-way communication device, or sends the information to another location. The functionally provided to the user of the two-way communication device is limited only by the applications available on a server computer that is accessible to the user over the two-way data communication network.

This invention allows for the first time two-way communications devices such as cellular telephones, two-way pagers, and telephones to become open application platforms which in turn empowers software developers to deliver value-added applications and services to any two-way communication device that incorporates the principles of this invention. This is a radical shift from the current situation where telephones and two-way pagers are closed, proprietary systems. Consequently, an even playing field is created for the market to invent new uses for two-way communication devices and for two-way communication networks. Any entity from corporations to individuals can make new applications available to the installed base of two-way data communication devices that include this invention without physical modification or addition to the two-way communication device. Years after purchase, a two-way communication device incorporating this invention will run all the applications which were developed since its purchase.

Further, all these applications are available without the end user having to add anything or make any modification to the two-way communication device. Also, the applications are independent of the two-way data communication network. The applications do not depend on any feature of the two-way data communication network. Thus, the applications are unaffected by a change in the two-way data communication network.

Also, the applications on the server computer are independent of the two-way data communication device with which the server computer is interacting. An application on the server computer can communicate with any two-way data communication device that includes the client module of this invention and a network interface module to transmit data over, and receive data from the two-way data communication network. These two features mean that an investment in developing an application is insulated from either advances in two-way data communication devices, or advances in two-way data communication network technology.

As indicated above, the two-way data communication device of this invention utilizes a client module to transmit a message including a resource locator selected by the user over the two-way data communication network to a server on a server computer on the computer network. For example, the computer network can be a corporate wide area network, a corporate local area network, the Internet, or any combination of computer networks.

The server processes the message, i.e, executes the application addressed by the resource locator and transmits a response over the two-way data communication network to the two-way data communication device, which stores the response in a memory. The client module interprets the response and generates a user interface using information in the response. In one embodiment, the user interface includes at least one user data input option that is associated with a resource locator. In another embodiment, the user interface is a display.

The resource locator associated with the at least one user data input option can address any one of a wide variety of objects. In one embodiment, the resource locator associated with the at least one user data input option addresses an object on the server computer that transmitted the response. In another embodiment, the resource locator addresses an object on another server computer coupled to the two-way data communication network. In yet another embodiment the resource locator addresses an object stored in the two-way communication device.

When the user selects the at least one user data input option, the client module interprets the selection and if required, appends any input data to the resource allocator associated with the at least one user data input option. The client module transmits a message including the resource locator with any appended input data to the server computer. Alternatively, the resource locator with any appended data can be addressed to another server computer, or can address an object stored in the two-way communication device. If the resource locator addresses an object on a server

computer, the client module provides the message to the network interface module which in turn transmits the message over the two-way data communication network.

Thus, in this embodiment, the message originally transmitted to the two-way data communication device included all the information necessary for the client module to generate the user interface, to associate the user selection and any data entered with a particular resource locator, and to transmit the appropriate resource locator in a subsequent message. The client module includes an interpreter that processed the information in the message. Since the message included all the information needed by the client module, the server computer that transmitted the message retained no state information concerning the message. Consequently, the server computer is defined as a stateless server computer.

An important aspect of this invention is that the message includes all information necessary for the client module to generate the user interface and a particular user interface can be independent from other user interfaces. Unlike prior art systems that gave the user a predetermined menu from which to select items, or limited the user to an E-mail like format, according to the principles of this invention, the user interfaces and possible interactions available to the user are determined only by the applications that developers make available. The possible interactions and user interfaces for one application can be totally different and independent from the possible interactions and user interfaces of another application. Thus, a cellular telephone, two-way pager, and a telephone all truly become an open platform.

These features of the invention are a significant departure from prior art systems. Typically, in the prior art, use of a particular application on a particular platform required that the application be compatible with the operating system on that platform. Further, each time a new version of the application was released, the user was required to take steps to update the application on the user's platform. Further, if the user of the platform did not modify the operating system as new versions of the operating system were released, at some point in time, the platform would no longer be capable of processing a new version of an application that required a current version of the operating system.

This invention eliminates these problems. As explained above, the client module in the two-way data communication device functions an interpreter. The application on the server computer provides all information necessary for the interpreter to generate a user interface on the two-way data communication device, and in response to user selections or data input using the user interface, to route messages to an appropriate server, i.e, either the server that sent the original information or another server.

Thus, the client module only interprets this information and interacts appropriately with the hardware of the two-way data communication device. Consequently, to update an application requires only changes on the server computer and not changes in each two-way data communication device that communicates with that server computer. This invention eliminates the usual requirement for distribution of application software, and application software updates to the end user of the two-way data communication device.

In one embodiment, a two-way data communication system for communication between a server computer and a two-way data communication device selected from a group consisting of a cellular telephone, a two-way pager, and a telephone, includes a two-way data communication network, a server computer coupled to the two-way data communication network, and a two-way data communication device coupled to the two-way data communication network. The server computer includes a two-way data communication interface module coupled to the two-way data communication network, and a server coupled to the two-way data communication interface module. The server receives a message including a resource locator from the two-way data communication network. The resource locator includes an address of the server computer and of an application on that server computer. The server processes the message using the resource locator. In this embodiment, the server transmits a response to the message over the two-way data communication network.

The two-way data communication device, selected from the group consisting of a cellular telephone, a two-way pager, and a telephone, includes a network interface module coupled to the two-way data communication network, and a client module coupled to the network interface module. The client module transmitted the message including the resource locator to the server over the two-way data communication network. The client module also processes the response to the message from the server. The response includes information for a user interaction over the two-way data communication network.

The client module of this invention is lightweight, and thus requires only lightweight resources in a two-way data communication device. Consequently, the client module can use existing resources in such a device and therefore does not add to the cost of the two-way data communication device.

In one embodiment, the interpreter within the client module includes a plurality of managers including a user interface manager coupled to a display of the two-way data communication device where the user interface manager handles interactions with the display. The user interface manager also is coupled to a keypad of the two-way data communication device and handle interactions with the keypad. Herein, a keypad can be a telephone keypad, the keys found on a two-way pager, or other data input interface of a two-way communication device.

In one embodiment, the response generated by the server computer includes a plurality of resource locators and at least one of the plurality of resource locators includes an address to another server coupled to the communication network.

According to the principles of this invention, a method for using a two-way data communication device, selected from a group consisting of a cellular telephone, a two-way pager, and a telephone, to communicate with a server computer includes:

- generating a message by a client module in response to data entered by the user of a two-way data communication device coupled to a two-way data communication network,
  - wherein the client module executes on a microcontroller of the two-way data communication device; and
  - the message includes a resource locator;
    - transmitting the message over the two-way data communication network to a server computer wherein the server computer is identified by the resource locator;
- executing an application on the server computer identified by the resource locator to generate a response to the message; and
- transmitting the response to a location identified by the application.

As indicated above the location can be the two-way communication device, another server computer, or some other device coupled to the server computer.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** illustrates one embodiment of the airnet network of this invention that includes the two-way data communication devices of this invention.

FIGS. **2**A to **2**H are illustrations of a series of screen displays of the two-way data communication device of this invention that illustrate one application of the principles of this invention.

FIGS. **3**A to **3**F are illustrations of a series of screen displays of the two-way data communication device of this invention that illustrate a second application of the principles of this invention.

FIGS. **4**A to **4**I are illustrations of a series of screen displays of the two-way data communication device of this invention that illustrate yet another application of the principles of this invention.

FIG. **5** illustrates another embodiment of the airnet network of this invention that includes the two-way data communication devices of this invention and an airnet network translator.

FIG. **6** is a block diagram of a mobile wireless communication device that includes the client and support modules of this invention.

FIG. **7** is a more detailed diagram of the mobile wireless communication device and a server computer within the airnet network architecture of this invention.

FIGS. **8**A to **8**D are a process flow diagram showing the process performed by the client in the mobile wireless communication device and the server on the server computer of FIG. **7**.

FIG. **9** is a diagram of a mobile wireless communication device of this invention that includes a novel predictive text entry system that is a part of this invention.

FIGS. **10**A to **10**T are one embodiment of a letter frequency table.

FIG. **11** is a process flow diagram for one embodiment of a data entry process that includes the novel predictive data entry process of this invention.

FIG. **12** is a more detailed diagram of the mobile wireless communication device and the airnet network translator within the airnet network architecture of the another embodiment of this is invention.

FIG. **13** is a process flow diagram showing the various processes performed by the airnet network translator of FIG. **12**.

FIG. **14** is a diagram illustrating the various module managers included in one embodiment of the client module of this invention.

Herein, objects with the same reference numeral are the same object. Also, the first number of a reference numeral indicates the Figure where the object first appeared.

DETAILED DESCRIPTION

According to the principles of this invention, a novel airnet network **150**, i.e., a two-way data communication network, interconnects any one, any combination, or all of two-way data communication devices **100**, **101**, or **102**, that each include this invention, with a wide variety of computer networks **120**, **130**, and **140**, for example. As explained more completely below, each two-way data communication device **100**, **101**, and **102** can be configured to transmit data to and receive data from any desired combination of computers on computer networks **120**, **130**, and **140**. Airnet network **150** is the two-way data communication path from the two-way data communication device to the particular computer that is accessed by the user of that two-way data communication device.

Each wireless communication device **100** that includes this invention can communicate over airnet network **150** with any server computer **121**, **131**, and **141** on airnet network **150** that includes at least one application that communicates and interacts with the processes of this invention that are included within device **100**. Thus, device **100** can access information on the computer network and provide information to the computer network. Similarly, a two-way pager **101**, and a telephone **102** with a modem **103**, that each include this invention, can communicate over airnet network **150** with any of server computers **121**, **131**, and **141** that includes at least one application that communicates and interacts with the processes of this invention that are included within devices **101** and **102**.

As explained more completely below, an application on a server computer can be accessed by any two-way data communication device that can communicate with that server computer. The application is independent of the particular type of two-way data communication device that is used to access the application and independent of the particular two-way data communication network used. This means that a user can access an application from anywhere so long as the user has a two-way data communication device that can communicate with the server computer.

In one embodiment, a process on wireless communication device **100** is configured as a client process and the applications on server computers **121**, **131** and **141** on airnet network **150**, that communicate with the client process, are server processes. This architecture allows some of the processing burden to be moved away from cellular telephone **100**, across airnet network **150**, to a server module on any computer on airnet network **150**.

Specifically, a wireless communication device **100** e.g., a cellular telephone, with a telephone like keypad, communicates via a data capable cellular telephone network **110**, e.g., a cellular digital packet data telephone network, with an application on a server computer on a computer network that has an interface to data capable cellular telephone network **110**. For example, the computer network can be a corporate wide area network **120**, a corporate local area network **130**, or perhaps the Internet **140**.

Similarly, a two-way pager **101** communicates via a two-way pager network **111** with an application on a server computer on a computer network that has an interface to two-way pager network **111**. Again, for example, the computer network can be a corporate wide area network **120**, a corporate local area network **130**, or perhaps the Internet **140**. Finally, a telephone **102** communicates via a modem **103** and public switched telephone network **112** with an application on a server computer on a computer network that has an interface to public switched telephone network **112**. As with the other two-way data communication devices, the computer network can be, for example, a corporate wide area network **120**, a corporate local area network **130**, or perhaps the Internet **140**.

In each of two-way data communication devices **100**, **101**, and **102**, the client process is stored as a client module in the device and the execution of the client module on a microcontroller in the device is sometimes referred to as the client process. The client process performs important processing functions locally. This allows the communication between the client process, hereinafter sometimes referred to as simply client, and the server process, hereinafter sometimes

referred to as server, to be minimized and the server computing requirements to grow slowly as the number of clients, i.e., users, grows.

The client module is small, e.g., under 64 KByte, and requires only low processing power congruent with the memory chips and built-in microcontrollers in two-way data communication devices such as cellular telephone **100**, two-way pager **101**, and telephone **102**. Thus, unlike the prior art attempts at an intelligent telephone, the cost, size, and battery life of either cellular telephones, two-way pagers, or telephones that incorporate this invention are not adversely affected.

While client/server architectures have been used extensively in computer networks, a client/server architecture implemented using two-way communication data devices such as cellular telephone **100**, two-way pager **101**, or telephone **102** yields new and unexpected results. This invention allows for the first time a wide variety of two-way data communication devices including but not limited to cellular telephones, two-way pagers, and telephones to become open application platforms which in turn empowers software developers to deliver value added applications and services to any two-way data communication device which incorporates the principles of this invention.

This is a radical shift from the current situation where cellular telephones, two-way pagers, and telephones are closed, proprietary systems. Consequently, an even playing field is created for the market to invent new uses for cellular telephones and data capable cellular networks, for two-way pagers and two-way pager networks, and for telephones on the public switched network.

Any entity from corporations to individuals can make new applications available to the installed base of data ready cellular telephones, two-way pagers, and telephones, that include this invention without physical modification or addition to the devices. Years after purchase, a two-way data communication device with this invention can run all the applications which were developed since its purchase. Further, all these applications are available without the user having to add anything or make any modification to the two-way data communication device. These features of the invention are a significant departure from prior art systems. Typically, in the prior art, use of a particular application on a particular platform required that the application be compatible with the operating system on that platform. Further, each time a new version of the application was released, the user was required to take steps to update the application on the user's platform. Further, if the user of the platform did not modify the operating system as new versions of the operating system were released, at some point in time, the platform would no longer be capable of processing a new version of an application that required a current version of the operating system.

Also, small devices, such as cellular telephones or pagers, usually do not have card slots, floppy or hard disk drives, or other means commonly found on computers to add or update applications. This limitation has led prior art attempts at intelligent communication devices to design closed systems with fixed functionality. Such devices can neither adapt nor be adapted to the fast changing requirements of the market place and so have not met with market success.

This invention eliminates these problems. The client process in the two-way data communication device functions an interpreter. The application on the server computer provides all information necessary for the interpreter to generate a user interface on the two-way data communication device, and in response to user selections or data input using the user interface, to route messages to an appropriate server, i.e, either the server that sent the original information or another server.

Thus, the client process only interprets this information and interacts appropriately with the hardware of the two-way data communication device. Consequently, to update an application requires only changes on the server computer and not changes in each two-way data communication device that communicates with that server computer. This invention eliminates the usual requirement for distribution of application software, and application software updates to the end user of the two-way data communication device.

For example, if initially, two-way pager **101** receives a response to a message from an application on server computer **121** on corporate wide area network **120**, the interpreter in two-way pager **101** generates a user interface on display screen **106** using information in the message. As described more completely below, options presented in the user interface can allow the user to access information, or provide information to any one, any combination of, or all of networks **120**, **130**, and **140**.

Specifically, in the response to the message from two-way pager **101**, the application initially accessed on server computer **121** included resource locators for applications on each of networks **120**, **130**, **140**, typically common gateway interface programs, accessible to the user of pager **101** as well as information required to generate the user interface. Consequently, when the user makes a particular selection or enters data, the interpreter accesses the appropriate resource locator and appends any necessary data to the resource locator. The client transmits a message including the resource locator to the appropriate server.

As shown by this example, the applications on networks **120**, **130**, **140** send to the two-way data communication device all information necessary to generate a user interface, and to process all user input. Consequently, only an application must be changed to update the information provided to the two-way data communication device.

In addition, since all the information needed by the client to generate a user interface and all information necessary for the client process to respond to any input data is included in the message, the computer server does not retain any state information concerning the information transmitted to the client process. Consequently, the computer server is stateless.

Each two-way data communication device **100**, **101**, and **102** that utilizes airnet network **150**, includes a data communication capability, a display screen, preferably a multi-line display screen, and storage capability for the processes of this invention in an on-board memory, and for the message being processed. Nearly every data capable cellular telephone, e.g., a telephone that utilizes a cellular digital packet data network, includes excess on-board memory capacity and a multi-line display screen. These hardware resources are often available, but unused in a data capable cellular telephone because of the indivisibility of memory chip packages. The inclusion of the processes of this invention in such cellular telephones therefore has very little effect on the cost, size, and power consumption of the cellular telephone. Similarly, the inclusion of the processes of this invention in two-way pagers and telephones, that include a microcontroller and memory, has very little affect on the cost, size, and power consumption of these devices.

Thus, unlike prior art approaches that attempted to combine a computer module and a wireless communication

module in a single package, this embodiment of the invention preferably utilizes the memory and processing power that currently exists in the cellular telephone **100**, two-way pager **101**, telephone **102** or other wireless or landline two-way data communication devices. This approach limits the cost of the resulting device and overcomes many of the problems of the prior art devices, e.g., the size and weight of the two-way data communication device is not changed, and, as explained above, updating user applications is removed from cellular telephone **100**, two-way pager **101**, and telephone **102**.

In particular, unlike devices produced by previous industry attempts at combining computing modules and a wireless cellular module, two-way data communication devices which incorporate this invention are size and cost competitive with voice-only telephones and can, for the first time, satisfy the market cost and size requirements for an intelligent cellular telephone, for example.

The incremental cost of supporting interactive applications on cellular telephone **100**, two-way pager **101**, and telephone **102** is reduced to at most a slightly larger screen that is required to display the application to the user. This is a fraction of the cost of adding a complete computer module to a cellular telephone, for example.

The incremental power consumption required to support this invention is also very small, as the incremental memory and screen required are small consumers of power compared to the cellular radio itself. Intelligent two-way data communication devices built according to the principles of this invention are not expected to have a significantly lower battery life than standard cellular telephones, or two-way pagers, for example.

The configuration and processes of the client process in two-way data communication devices **100**, **101**, and **102** are similar when the differences in the devices and the two-way data communication network over which the devices communicate are considered. Consequently, in the following description, the operation of data-ready cellular telephone **100** is considered. The same or similar operations can be performed on two-way data communication devices **101**, and **102**. The main difference is that some device dependent features within the client module must be changed to accommodate the particular hardware used in the two-way communication device. However, the client module architecture described more completely below limits the number of changes that must be made.

As indicated above, in response to user actions, wireless communication device **100** transmits a message, typically a data request, to a server computer **121** on computer network **120** and receives a response to the message. Alternatively, the user action can result in directions to server computer **121** on computer network **120** to transmit the response to the message to another location or to another user. Also, wireless communication device **100** can receive a message from any one of the computers coupled to airnet network **150**.

An important aspect of this invention is that the client module interpreter in wireless communication device **100** generates a user interface by which the user can both initiate and receive messages from a variety of applications. The interactions take place in realtime and are not limited by the client module interpreter. The uses of wireless communication device **100** are limited only by the availability of applications on server computers.

The applications available are determined by application developers. Prior to considering one implementation of the invention in further detail, several illustrative examples of applications that can be implemented according to the principles of this invention are described. These applications are illustrative only and are not intended to limit the invention to the particular applications and features described.

In one use, the user configures cellular telephone **100** to access server computer **121** on XYZ corporate wide area network **120**. In response to the access by the user, server computer **121** transmits a card deck to cellular telephone **100** over data capable cellular telephone network **110**. As explained more completely below, a card deck includes one or more cards, and each card is interpreted by the client module to generate a user interface screen.

In the embodiment illustrated in FIG. **2**A, the initial card deck transmitted to cellular telephone **100** includes an introductory display card and a choice card. FIG. **2**A is an example of introductory screen display **200** that is generated on display screen **105** by the client process in cellular telephone **100** by interpreting the display card. As used herein, a display screen is the physical display apparatus in a two-way communication device. A screen display is the image presented on the display screen.

In this embodiment, display screen **105** is a pixel display that displays graphics. In another embodiment, display screen **105** displays only text and so the graphics would not appear on display screen **105**. Screen display **200**, and other screen displays described more completely below, include a horizontal arrow, i.e., a multi-card deck indicator, to communicate to the user that the current deck includes another card. The inclusion of screen indicators, such as the multi-card deck indicator, to communicate with the user is optional. The functionality of this invention is independent of such screen indicators.

When the user presses a predetermined key, or key sequence, the client process in cellular telephone **100** interprets the next card in the card deck, i.e., the choice card, and in turn generates a menu **201** (FIG. **2**B) of items that can be accessed by the user. In this embodiment, each of the menu items is available on server computer **121** to the user who, in this example, is a representative of XYZ corporation visiting ABC Designs.

As explained more completely below, each of the menu items is associated with a resource locator that includes an address of the particular object associated with that menu item, typically an address to a common gateway interface program on server computer **121**. In general, a resource locator includes an address and may include appended data. The address can be to a local object within the two-way data communication device or to a remote object on a server computer. As is known to those skilled in the art, the common gateway interface is an Internet standard that is used to dynamically generate information, e.g., cards. In view of this disclosure, other techniques to generate dynamic cards could be used.

Initially, the highlighting of the first line of menu **201** is not present. When a key on the keypad of cellular telephone **100** is pressed, the menu item corresponding to that key is highlighted on screen **105**. Thus, menu **201** shows the first item highlighted to indicate that the one key was pressed by the user. However, highlighting a selected item is a feature that is specific to this example, and in general is not required to implement the invention. Other methods can be used to indicate the user's choice on display screen **105** such as an arrow pointing at the choice, if such an indication is desired.

After the one key is pressed, the user presses a predetermined key, e.g., an enter key, to verify the selection. Alternatively, in another embodiment, the verification of the

selection is not required. In both embodiments, the resource locator for the selection is transmitted to server computer **121** by the client process in cellular telephone **100** over data capable cellular telephone network **110**. In response to the selection, server computer **121** processes the message containing the selection, and in this embodiment, transmits another card deck to cellular telephone **100**.

The client process in cellular telephone **100** interprets the first card in the deck received from server computer **121**, which is a choice card, and generates a screen display **202**, that includes a second menu as illustrated in FIG. **2**C, on display screen **105**. Initially, none of the items in the second menu are highlighted.

Notice that screen display **202** includes a header, that describes the selection made by the user on screen display **201**, in addition to the second menu of choices available to the user. A multi-display screen card indicator **203**, e.g., in this embodiment, a hand icon with a finger pointing down, shows that the screen associated with the current choice card includes additional items that are not shown on display screen **105**. Herein, a screen can be larger than the number of lines available on display screen **105** and so the user must scroll the screen display to view the complete screen.

Thus, to view the additional items, the user presses a first screen scroll key, e.g., a next key, on cellular telephone **100**. In this embodiment, when the first screen scroll key is pressed, each line of the display is rolled up one line. The resulting display has an icon with a finger pointing up (not shown) if the menu requires only two screen displays. If the menu requires more than two screen displays, the second screen display of the menu would have two icons, one with a finger pointing up, and another with a finger pointing down. To scroll between the various lines in the second menu, the user uses the first screen scroll key, and a second screen scroll key.

If the user displays the last line of a card, e.g., the last line in the second menu, and presses the first screen scroll key nothing happens. In this embodiment, the user must make a choice before the next card is available.

Screen display **202** also includes representations of two soft keys, a home key **204**, and an info key **205**. In this example, these soft keys are defined only for the card used to generate screen display **202**. When the user presses a predetermined key sequence, the home key is highlighted to indicate the selection. In this embodiment, when the home key is selected, the user is returned to screen display **200**. In another embodiment, the user could be returned, for example, to a home screen display that is displayed each time the user activates cellular telephone **100** for use on airnet network **150**.

The home key is associated with a pointer, that in one embodiment is a resource locator, and the card addressed by the pointer is displayed by the client process when the home key is selected by the user. Specifically, if the pointer is to a card in the current deck, the client process simply displays that card. If the pointer is to other than a card in the current deck, the client process in cellular telephone **100** retrieves the deck containing the card at the location identified by the pointer. The location could be, for example, either a memory in cellular telephone **100**, or a memory in computer **121**.

Similarly, when the user presses another predetermined key sequence, the info key is highlighted to indicate the selection. In this embodiment, when the info key is selected, a help screen is displayed for the user that describes the possible selections. The particular contents of the help screen are determined by the provider of the service. Specifically, a pointer is associated with the info key and when the info key is depressed by the user, the information stored at the location identified by the pointer is retrieved and interpreted by the client process in cellular telephone **100**.

Returning to the menu in FIG. **2**C, since the user wants to determine the status of an order, the user pushes the two key on the keypad of cellular telephone **100**. In response to the key press, the second choice in the menu is highlighted as shown in FIG. **2**C. In response to verification of the key press, e.g., the user presses a predetermined key sequence, cellular telephone **100** transmits a check open order request to computer **121**, i.e, the client process transmits a message that includes a resource locator associated with the menu item selected by pressing the two key.

In response to the check open order request, computer **121** transmits yet another card deck to cellular telephone **100**. The client process in cellular telephone **100** interprets this deck, that is an entry card, and in turn generates a purchase order number entry screen display **206** (FIG. **2**D) on display screen **105**. Notice that screen display **206** has a previous soft key **207** and a fax soft key **208**. Again, each of these soft keys has an associated pointer and the information stored at the location identified by the pointer is retrieved and interpreted by the client process when the user selects the soft key.

In this example, the user does not select a soft key, but rather the user enters the purchase order number as shown in FIG. **2**E using the keypad of cellular telephone **100**. The user enters only the various numbers. The client process formats the number and inserts the dashes as shown in FIG. **2**E.

After the purchase order is entered, the user presses a predetermined key sequence to indicate to the client process that entry of the purchase order number is complete. Notice that the user is entering data and not simply selecting a menu item. The user is utilizing cellular telephone **100** as if cellular telephone **100** was a computer connected to network **120**, but, as explained more completely below, cellular telephone **100** is similar to a standard digital data capable cellular telephone that communicates over data capable cellular telephone network **110**. Specifically, cellular telephone **100** is not a combination of a computer module and a wireless communication module as in prior art attempts to create an intelligent telephone.

In addition, the user enters data using only the standard cellular telephone keypad. Thus, cellular telephone **100** eliminates the need for a computer keyboard or for a sophisticated touch screen that recognizes motion of a pointing object. This is important to maintaining the size, weight, and power requirements of cellular telephone **100** similar to those of a voice-only cellular telephone. In one embodiment, to facilitate data entry, as explained more completely below, cellular telephone **100** includes a text prediction process that reduces the number of key strokes required to enter text data. In this embodiment, the text prediction process is turned on or off for each entry card.

In response to entry of the purchase order number, the client process transmits a request to server computer **121** for the particular purchase order. Specifically, the client process appends the entered data to a resource locator and transmits a message containing the resource locator to server computer **121**. Server computer **121**, in response to the message, retrieves the appropriate purchase order and transmits the purchase order as a card deck to the client process in cellular telephone **100** over airnet network **150**.

The client process interprets the card deck and generates a screen display **209** (FIG. **2**F). Initially, fax key **208** is not highlighted in screen display **209**.

Notice that screen display **209** includes multi-display screen card indicator **203** to show the user that the purchase order screen contains more information that can be displayed at one time on display screen **105**.

After the user reviews the purchase order, the user presses the key sequence for fax key **208** and in response, fax key **208** is highlighted as illustrated in FIG. **2**F.

In response to selection of fax key **208**, the client process retrieves the card deck at the location identified by the pointer associated with fax key **208**. If the location is on server computer **121**, the client process transmits a message including a resource locator to server computer **121** and in response to the message, server computer **121** transmits back yet another card deck. If the location is on a server computer other than server computer **121**, the client process transmits a message including a resource locator to that server computer and in response to the message, that server computer transmits back yet another card deck. If the location identified by the pointer is within cellular telephone **100**, the client process simply retrieves the deck. In either case, fax form **210** (FIG. **2**G), that is an entry card, is displayed on display screen **105** by cellular telephone **100**. This example demonstrates the information accessed by the client process can be located in any number of locations. The resource locator associated with the fax key identifies the appropriate location.

When fax form **210** is displayed, the user enters the facsimile machine telephone number at ABC Designs, as shown in FIG. **2**H, using the cellular telephone keypad. In this embodiment, the telephone number is automatically formatted by the client process. After the telephone number is entered, the client process appends the telephone number to a resource locator and transmits the information to server computer **121**.

When server computer **121** receives the information, server computer **121** executes a common gateway interface application (CGI) pointed to by the resource locator. The CGI application grabs the necessary information and transmits the information via e-mail to a fax gateway. The fax gateway, upon receipt of the e-mail, converts the information to a fax and sends the information to the specified telephone number. Thus, cellular telephone **100** requires neither a printer connection nor a print driver, but yet can print using the facsimile machine at ABC Designs.

As illustrated in this example, cellular telephone **100** transmitted a request for a particular purchase order, and scheduled transmission of data responsive to the request to a local machine capable of printing the data. Thus, the processes of this invention, as described more completely below, in cellular telephone **100** in combination with data capable cellular telephone network **110** and server computer **121** permit cellular telephone **100** to effectively utilize an application on server computer **121** on network **120** even though cellular telephone **100** utilizes only a microcontroller found in telephone **100** and does not required a separate computer module as in the prior art.

In addition, the client process using the information transmitted from server computer **121**, i.e, the cards, generates a wide-variety of user interfaces as illustrated in FIGS. **2**A to **2**H. The particular configuration of the various user interfaces is defined by the cards transmitted in a card deck. Consequently, the user interface is not fixed to one particular format such as an E-mail type format, but rather the format is variable and can be redefined by each card that is interpreted by the client process. Also, in general, the user interface for one application on a server computer is independent from the user interface for another application on that server computer.

Specifically, the application accessed on server computer **121** generates the card deck and so in turn defines each of the various user interfaces. Each user interface permits the user to identify a particular selection. Each particular selection could result in generation of a different user interface with different selections. Thus, the user interfaces are limited only by the applications accessible to the two-way data communication device.

As shown below, a wide variety of applications can be provided on a server computer. Despite the robustness of the client module in interpreting a wide variety of application, typically, the client process is lightweight and thus requires only lightweight resources, e.g., 60 Kbytes of read-only memory (ROM) for the client module, 10 Kbytes of random access memory (RAM), and less than one million instructions per second (MIPS) of processing power. Since the client process needs only these lightweight resources in a two-way data communication device, the client can use existing resources in such a device and therefore does not add to the cost of the two-way data communication device such as data capable cellular telephone **100**.

In another embodiment, the user can configure cellular telephone **100** to access server computer **131** on corporate local area network **130**. In response to the access by the user, computer **131** transmits a home card (not shown) to cellular telephone **100** which in turn generates a home screen display on display screen **105**.

When the user selects personal information on the home screen display or on a subsequent screen display associated with the home card, a message including a resource locator for a personal information deck is transmitted from cellular telephone **100** to computer **131**. In response to the message, computer **131** transmits a card deck that includes a display card and a choice card to cellular telephone **100**. In these examples, the card deck is described as including one of three cards, a display card, a choice card, and an entry card. However, these examples are illustrative only, and are not intended to limit the invention to those particular embodiments of cards. In view of this disclosure, those skilled in the art will be able to form combinations of these types of cards and define other types of cards, if such cards are appropriate for the particular application.

The client process in cellular telephone **100** interprets the display card that includes image and text data and generates screen display **300** on display screen **105** (FIG. **3**A). Screen display **300** includes a home key **301**, and an info key **302**. When the user selects home key **301**, the user is returned to the home screen. Info key **302** functions in a manner similar to that described above for info key **205**.

When the user presses a predetermined key, the client process interprets the choice card and a second screen display **304** (FIG. **3**B) is driven on display screen **105**. Screen display **304** is a menu of the personal information that is stored on server computer **131** for use by the user of cellular telephone **100**. Multi-display screen card indicator **203**, e.g., the hand with a finger pointing down, illustrates to the user that the list has additional items that appear on the next screen display. Screen display **304** also indicates the number of E-mail messages, faxes, and voice messages waiting for the user.

The user scrolls the screen display line by line until screen display **305** is on display screen **105**. Initially, the fourth item in the menu is not highlighted. In this example, the user presses the four key on the keypad of cellular telephone **100**

to view the user's schedule. In response to the key press, the client module in cellular telephone **100** transmits a message, including a resource locator associated with the menu item selected by pressing the four key, to server computer **131** using data capable cellular telephone network **110** and corporate local area network **130**.

In response to the message, server computer **131** executes the application identified in the resource locator. Upon completion of the execution, server computer **131** transmits, over corporate local area network **130** and data capable cellular telephone network **110** to cellular telephone **100**, a card deck that includes a choice card that describes the user's schedule for that day.

In this embodiment, when server computer **131** completes the transmission, server computer **131** has completed the response to the message and has transmitted all necessary information to cellular telephone **100**. Therefore, server computer **131** does not retain any state information concerning the transmitted information and so is referred to as a stateless server computer **131**. In this embodiment, the client process can only request a card deck. However, as demonstrated herein, card decks and the two-way interactive data communication system of this invention provide the user with a new level of capability.

When cellular telephone **100** receives the card deck, the client process in cellular telephone **100** interprets the choice card and drives screen display **306** (FIG. **3**D) on display screen **105**. Initially, the first item in the menu of screen display **306** is not highlighted. When the user depresses the one key on the keypad of cellular telephone **100**, cellular telephone **100** highlights the first item in the menu. Cellular telephone **100** generates screen display **308** (FIG. **3**E) upon the user subsequently depressing a predetermined key. Screen display **308** includes a schedule key **309**, that when selected returns the user to screen display **306** (FIG. **3**D). Screen display **308** also includes a more detailed description of the 10:00 a.m. meeting.

While screen display **308** is active, if the user depresses a predetermined key, the user is presented with the options in screen display **310** (FIG. **3**F). Initially, item two in screen display **310** is not highlighted.

In this example, the user depresses key two on the keypad of cellular telephone **100** and so cellular telephone **100** sends a message including a resource locator to server computer **131** to send an E-mail message to Bill Smith confirming the meeting at 10:00 a.m. When server computer **131** executes the application addressed by the resource locator, an E-mail message is sent.

In another example, the user of cellular telephone **100** connects to Internet service provider computer **141** on Internet **140** using data capable cellular telephone network **110**. Upon connection of cellular telephone **100**, service provider **141** transmits to cellular telephone **100** a card deck to generate FIGS. **4**A to **4**C.

The client process in cellular telephone **100** interprets the first card in the card deck from computer **141** and generates screen display **400** (FIG. **4**A). When the user presses a predetermined key, cellular telephone **100** displays screen display **401** (FIG. **4**B). Screen display **401** provides the user with a series of choices that group services alphabetically.

When the user depresses the seven key on the keypad of cellular telephone **100**, cellular telephone **100** displays a list of the services that have letters P, R, or S as the first letter in the service name. In this embodiment, screen displays **401** and **402** are a single card, e.g., a single screen. Each of the various services associated with a key has an index and when a particular choice is made by the user, the choice defines an index. The client process then displays all of the services with the index that corresponds to the index defined by the user's choice.

In screen display **402**, the user is given a series of choices of services that are available to the user under tab seven. Initially, item three in screen display **402** is not highlighted. In this example, the user depresses the three key on the keypad of cellular telephone **100** to select the stock quotes and item three in screen display **402** is highlighted.

In response to this selection, cellular telephone **100** transmits a request for a stock quote, i.e, a message including a resource locator, over cellular telephone network **100** and internet **140** to service provider **141**. In response to the request, service provider computer **141** executes the application addressed by the resource locator. The application retrieves a card deck that, in turn is transmitted to cellular telephone **100**. The card deck includes a display card and an entry card.

Upon receiving the card deck, the client process in cellular telephone **100** interprets the display card and generates screen display **403** (FIG. **4**D). When the user depresses a predetermined key, entry screen display **406** (FIG. **4**E) is generated on display screen **105** of cellular telephone **100**.

Initially, the box with letters SUNW in screen display **406** is empty. The letters SUNW are entered in the box by the user to indicate the ticker symbol of the stock for which the user wants information. After the user has entered the stock ticker symbol, the user presses the predetermined key to indicate that the entry is complete.

In response to the entry by the user, the client module appends the stock ticker symbol to the resource locator and transmits the resource locator to service provider computer **141** which, in turn, executes an application addressed by the resource locator to retrieve the latest stock market information for the stock ticker symbol. Service provider **141** uses the retrieved information to generate a card deck that contains the information and then transmits the card deck to cellular telephone **100**.

The client process in cellular telephone **100** interprets the first card in the deck and generates screen display **409** (FIG. **4**F). For convenience, the FIGS. **4**F to **4**I are grouped together and separated by a dotted line. However, at any given time, in this embodiment, display screen **105** can display any four adjacent lines and so the grouping of lines in FIGS. **4**F to **4**I is for convenience only to demonstrate the level of information that can be retrieved and displayed by the client process. The use of a four line display screen is illustrative only. The client process of this invention can work with any size display screen, even a one line display screen. However, a multi-line display screen is preferred.

In the Figures discussed above, the display screen is a pixel display and so can display images. In another embodiment, the display screen only displays text and is smaller in size. For such an embodiment, the various entries are abbreviated and only text is displayed, but the general operation is identical to that just described. Also, the various computer networks can be interlinked so that a user with access to one computer network can obtain information on another computer network. Moreover, the embodiments described above are merely illustrative. One important aspect of this invention is that cellular telephone **100** can interact with any type of server application that is configured to communicate with and interact with the client process in cellular telephone **100**. Thus, the user is no longer limited to only a few services offered by a telephone network provider.

In FIG. **1**, the cellular telephone user must address, i.e., connect to, each computer of interest to access the different services. Consequently, each computer requires the information necessary to communicate with cellular telephone **100**. In another embodiment, not illustrated, cellular telephone **100** contacts a single central computer over data capable cellular telephone network **110**. This computer is connected to each of the other networks illustrated in FIG. **1**. Consequently, the user of cellular telephone **100** sends a message including a resource locator to the central computer, the central computer processes the message and retrieves the information addressed by the resource locator from the appropriate network shown in FIG. **1**. After the requested information is retrieved, the central computer generates a card deck and transmits the card deck to cellular telephone **100**. In this embodiment, only one computer must be configured to communicate with cellular telephone **100**. However, that same computer must be configured to communicate with all other computer networks that are of interest to the user of cellular telephone **100**.

Hence, according to the principles of this invention, the client process on a two-way data communication device can initiate an interaction with a particular server computer. The server computer transmits (i) information to the client process to generate a user interface, and (ii) a resource locator for each possible selection by the user from the user interface. The resource locators can address applications on the server computer, applications on over server computers, or an application on the server computer that in turn accesses other server computers. Consequently, the user of a two-way data communication device is limited only by the applications provided on the server computers.

Further, the user can be provided new and/or updated capabilities by modifying the applications on the server computers. There is no requirement that the client process be changed for a new or updated application. The client process must only interpret the information received from an application and transmit a message for additional information. These operations are unaffected by a new or updated application. Consequently, as noted above, this invention does not require distribution of application updates or new applications to the end user of the two-way data communication device.

FIG. **5** is an illustration of another embodiment of airnet network **150**. In this embodiment, the messages from a two-way data communication device, e.g., devices **100**, **101**, and **102** are directed to an airnet network translator **500**. Airnet network translator **500** and a particular two-way data communication device, e.g., any one of devices **100**, **101**, and **102** communicate using the protocol for point-to-point communication on the particular network linking airnet network translator **500** and that two-way data communication device. For example, if data capable cellular telephone network **110** is a cellular digital packet data network, either the transmission control protocol (TCP) or the user datagram protocol (UDP) can be used.

Airnet network translator **500** transfers data between the two-way data communication device and the selected computer network after translator **500** validates the communication path, as explained more completely below, and encrypts the message transferred to the computer network if necessary. In addition, airnet network translator **500** collects transaction and billing information concerning the communication between the two-way data communication device and the designated computer network. Specifically, airnet network translator **500** provides access control for paying services and a logging mechanism for billing. Airnet network translator **500** can also provide a directory service to users.

FIG. **6** is a block diagram of a typical GSM digital cellular telephone. Each of the hardware components in cellular telephone **600** is known to those skilled in the art and so the hardware components are not described in detail herein. The compiled and linked processes of this invention are stored in ROM **601** as a client module **602** and support modules **603**. Upon activation of a predetermined key sequence utilizing the keypad, physical layer processor **610**, that is sometimes referred to herein as a microcontroller, initiates a client process using client module **602** in ROM **601**.

In this embodiment, client module **602** includes a plurality of manager modules, as explained more completely below. The particular manager modules utilized is determined by the characteristics of the particular cellular telephone **100** in which client module **602** is implemented. Client module **602** must include manager modules to interface with modules that control the particular hardware in cellular telephone **100**, a manager module to interface with the particular cellular telephone network protocol used by cellular telephone **100**, and a manager module to interpret the card decks received. Therefore, the particular manager modules described herein are only illustrative of the principles of this invention and are not intended to limit the invention to the specific modules described more completely below.

In this embodiment, the client process controls the operations of a plurality of cellular telephone dependent support processes that are stored in ROM **601** such as a display module, a keypad module, and a network and terminal control module, that were referred to above collectively as support modules **603**. The combination of the client process, display process, keypad process, and network and terminal control process are considered foreground tasks by the microkernel in cellular telephone **600**. Also, herein module and process are used interchangeably, but those skilled in the art will appreciate that the module is the computer software as stored in a memory, preferably, a ROM, of cellular telephone **600** and the corresponding process is the execution of the module by the microcontroller in cellular telephone **600**. Again, note that this invention does not require a separate processor and instead can utilize the processing power that already exists in cellular telephone **600**, because as described above, the client process of this invention is so lightweight.

The user interface for cellular telephone **600** determines the version of the user interface manager module that is stored in ROM **601**. In one embodiment, the parameters used to define the user interface level are the display resolution, the pixel access of the display, and the support of soft keys. One definition of the user interface levels is given in Table 1.

TABLE 1

USER INTERFACE LEVEL DEFINITIONS	
Level 1	Text only; 1 or more lines; 12 to 15 characters per line; and no soft keys.
Level 2	Text only; 4 or more lines; 20 to 25 characters per line; and soft keys.
Level 3	Pixel access; 150 by 75 pixels or larger; and soft keys.

The user interface manager module presents data to the display module which in turn drives display screen **605**; and captures data entered by the user on display screen **605**. In

response to this information, the client process prepares a message for transmission by a network manager module.

To more completely explain the operations performed over airnet network **150**, FIG. **7** is a block diagram that illustrates the various components in one embodiment of this invention of cellular telephone **700**. Those skilled in the art will appreciate that cellular telephone **700** includes circuitry and software similar to that illustrated in cellular telephone **600** for voice and data operations supported by cellular telephone **700** in addition to the modules for operation on airnet network **750**. Similarly, server computer **743** includes other software and hardware that is known to those skilled in the art and so is not illustrated in FIG. **7** for clarity.

In this embodiment, client module **702** in digital cellular telephone **700**, that is executing on the microcontroller of telephone **700**, communicates with server computer **743** over cellular digital packet data (CDPD) network **710**. Cellular digital packet data network **710** is used to illustrate one embodiment of this invention on one two-way data communication network. The principles of this invention can be used with a wide variety of two-way data communication networks. For example other two-way data communication networks for cellular telephones that may be used include TDMA, CDMA, and GSM circuit switched data networks; and the AMPS analog cellular network with a modem. Similarly, for two-way pagers, two-way data communication networks include PACT, or other priority two-way paging networks with data transport capability.

Prior to considering the operation of this configuration of airnet network **750** in more detail, another aspect of this invention is required. Specifically, a technique is required for conveying instructions from digital cellular telephone **700** to a server application on server computer **743**, and conversely.

A telephone interaction description language (PIDL) is defined for use by service developers. A terminal interaction language (TIL) is a distillation of the telephone interaction description language and describes the same interaction to digital cellular telephone **700** as the telephone interaction description language describes to computer **743**.

With the exceptions described more completely below, a process in the terminal interaction language is a compressed version of the same process written in the telephone interaction description language. The terminal interaction language allows easy parsing on the two-way data communication device, which in turn makes the client smaller than a client for the telephone interaction description language that is readable by humans, but is not optimized for parsing by a machine.

The compression from the telephone interaction description language to the terminal interaction description language is done typically at run time because some cards are computed cards and so cannot be precompiled. A wide variety of techniques can be used to convert the telephone interaction description language to terminal interaction language. The important aspect is that, if bandwidth across the cellular telephone network is limited, a compressed form of the telephone interaction description language is used.

Preferably, each data type is compressed to facilitate optimal transfer over the two-way data communication network. For example, the verbs in the telephone interaction description language are compressed using a binary tokenization. Graphics are compressed using run length limited compression and text is compressed using any one of the well-known techniques for text compression. While compression of the telephone interaction description language is not required to implement this invention, compression makes the invention more efficient by utilizing the bandwidth of the network more effectively.

Instructions in the telephone interaction description language and in the terminal interaction language are grouped into a deck and a card. Each deck includes one or more cards. A card includes the information, i.e., a set of telephone interaction description language, required to generate a screen. As indicated above, a screen can be larger than the number of lines in a display screen. Other equivalent terms for a card include a page and an atomic interaction. Thus, a card deck is simply a group of screens. The number of cards in a card deck is selected to facilitate efficient use of the resources in the two-way data communication device and in the airnet network.

For simplicity, in this embodiment, each card is a single operation. Herein, an operation is defined as a related set of actions such that the user does not encounter an unanticipated delay in moving from one action to the next, i.e, the user does not have to wait for client module **702** to retrieve another card deck from computer **743**. Also, a deck may include definitions of soft keys that stay in force while the deck is active, i.e, being executed by the cellular telephone microcontroller.

Computer **743** may contain stored static telephone interaction description language decks. Computer **743** also generates telephone interaction description language decks in response to data from, or choices made by, the user of cellular telephone **700**.

In the embodiment shown in FIG. **7**, computer **743** converts a telephone interaction description language deck to a terminal interaction language deck, that in turn is transmitted to cellular telephone **700**. The terminal interaction language is designed so that decks can be stored unaltered in memory **716** of cellular telephone **700** and referenced directly with little or no parsing. While telephone interaction description language decks on computer **743** may contain references to images, a terminal interaction language deck contains the images at the end of the deck. Thus, if a particular two-way data communication device does not support display of images, the images are easily stripped from the terminal interaction language deck before the deck is transmitted to that particular two-way data communication device.

As indicated above, each interaction with the user of cellular telephone **700** is described by a deck or a series of decks Logically, the user retrieves a terminal interaction language deck stored in a memory **716** of cellular telephone **700** after receipt from computer **743** over CDPD network **710**. The user reviews the information displayed by cards in the deck and makes choices and/or enters requested information and then requests another deck, as described above with respect to FIGS. **2**A to **2**H, for example.

When the user receives a deck, the first card of information is displayed on display screen **705**. Typically, as shown above, the first card is text, an image, or a combination of an image and text. After the user has reviewed the first card, the user hits a NEXT key to view the next card in the deck. Similarly, a user can return to a previous card in the deck by using a PREV key. Thus, using the NEXT and PREV keys, the user can navigate back and forth through the deck. Within a card, the user uses a scroll key or keys to move the portion of the card displayed up and down. This description of a particular method used to navigate through a deck and within a card is not intended to limit the invention to this particular method. In view of this disclosure, those skilled in

the art will be able to use a wide variety of ways to navigate through a deck and within a card.

Cards, in this embodiment, are one of three types, a display card, a choice card, and an entry card. Independent of the type of card, the card can contain text and images. In addition, the invention is not limited to these three particular types of cards. The definition of the three particular types of cards is used to facilitate a description of the invention and to assist the developer's in organizing applications.

A display card gives information to the user to read. The display content can include any one of, or any combination of text, an image, and a soft key. The soft key is in effect only while the display card is active.

A choice card displays a list of choices for the user. The choices are automatically presented in a format specified on the choice card. See Appendix I, which is a part of the present disclosure and is incorporated herein by reference in its entirety. As explained above, the user makes a choice by depressing the key corresponding to the choice.

An entry card is used to obtain input data from the user. An entry card displays one or more entry lines. Typically, each entry line includes a display followed by an entry line. The entry line, in this embodiment, can be for either numeric or text data.

In this embodiment, choice and entry cards prevent the user from moving to the next card until the user has entered the requested information. When the user reaches the last card in a deck and hits the NEXT key, a request for a new deck is initiated. The deck requested is determined by either the deck that the user has completed, or by the choices made by the user. Also, when the deck is completed, the choices and/or data entered by the user typically are transmitted along with the request for the new deck to computer **743**.

Appendix I is one embodiment of a syntax for the telephone interaction description language and the terminal interaction language of this invention. In one embodiment, the telephone interaction description language is described using a subset of the standard generalized markup language. Only a subset of the standard generalized markup language is utilized so that telephone interaction description language parsers also can be written easily using simple tools like lex and yacc.

Returning to operation over airnet network **750**, cellular telephone **700** includes a display module **712**, a keyboard module **711**, a client module **702**, and a UDP interface module **714**. In this embodiment, module **702** is stored in a non-volatile memory (not shown) of telephone **700** and is executed by the microcontroller (not shown) in telephone **700**. Modules **711**, **712**, and **714** operate under the control of client module **702**.

Client module **702** includes instructions that direct the microcontroller in cellular telephone **700** to perform the operations described more completely below with respect to FIGS. **8**A to **8**D. The operations include sending uniform resource locator (URL) requests to HyperText Transfer Protocol (HTTP) server **749**, parsing and displaying a TIL deck or decks returned by HTTP server **749**, and generating new URLs based on the user's key presses. For a description of HTTP server software and platforms that can run the HTTP server software, see, for example, Ian S. Graham, *The HTML Sourcebook*, John Wiley & Sons, Inc., New York, Chapt. 8, (1995), which is incorporated herein by reference.

User datagram protocol (UDP) interface module **714** couples CDPD network **710** to client module **702**, and allows client module **702** to communicate using UDP over CDPD network **710**. The user datagram protocol is well known to those skilled in the art and is documented extensively. UDP interface module **714** supports transmission of simple stand-alone messages between the connection partners.

Display module **712** is a display driver that couples client module **702** to display screen **705** and so allows client module **702** to specify the information presented on display screen **705**. The user interface manager module within client module **702** converts the display information in a card to instructions for display module **704** which in turn provides signals that drive the hardware that controls the operation of display screen **705**. For example, if the TIL deck includes an image, the user interface manager module determines whether the active card calls for display of the image. If the active card directs the user interface manager module to display the image, the user interface manager module passes the image in memory **716** to display module **712**, which in turn displays the image on display screen **705**.

Keyboard module **705** couples keypad **715** to client module **702**, and stores data representing keys pressed by the user on physical keypad **715** in memory **716**. Keyboard module **705** notifies client module **702** when the user has pressed a key.

When client module **702** is notified of a key press, the user interface manager module within client module **702** passes information about the key press to display module **712** that in turn displays the appropriate character on display screen **705**, if an entry card is active. If the user interface manager module determines that a choice card is active, and the key press corresponds to one of the choices, the user interface manager module sends instructions to display module **712** that result in the choice being identified for the user, e.g., highlighted as described above.

In addition to HTTP server **749**, host computer **743** includes a UDP interface module **748**, CGI programs **761** stored in a memory **755** of host computer **743**, and TIL decks **760** stored in memory **755**.

HTTP server **749** uses UDP interface module **748** to send data to and receive data from CDPD network **710**. TIL decks **760** are TIL decks that can be accessed by HTTP server **749**. Static files containing PIDL decks are converted to TIL decks only once on HTTP server **749**. CGI programs **761** are common gateway interface programs that produce PIDL decks that are used by HTTP server **749** to produce TIL decks that in turn are transmitted via UDP interface modules **748** and **714** and cellular telephone network **710** to client module **702**. In this embodiment, the services available over airnet network **750** are applications accessible by HTTP server **749** on Internet **140** for which a service developer has written a PIDL deck, or a CGI script that in turn generates a PIDL deck, and is stored on computer **743**.

The architecture in FIG. **7** demonstrates some important aspects of this invention. First, the applications, the PIDL decks and CGI scripts in this embodiment, are independent of the particular two-way data communication network. For HTTP server **749** to communicate over a different two-way data communication network that does not support UDP, only UDP interface module **748** must be changed. The applications are unaffected by such a change.

Second, the applications on HTTP server **749** are independent of the two-way data communication device with which HTTP server **749** is interacting. An application on HTTP server **749** can communicate with any two-way data communication device that includes the appropriate client and a module to transmit and receive data over the two-way data communication network. These two facts mean that an

investment in developing an application is insulated from either advances in two-way data communication devices, or advances in two-way data communication network technology.

FIGS. **8**A to **8**D are a process flow diagram for one embodiment of this invention. Initially, when the user initiates communication over airnet network **750**, client module **702** initializes a work space in memory **716** of cellular telephone **700** and then, in get home URL process **801**, stores a URL in the work space. According to the principles of this invention, in one embodiment, each cellular telephone that utilizes the airnet network has a home URL stored in a non-volatile memory that is used to retrieve a home card deck for the cellular telephone. In another embodiment, the cellular telephone obtains the home URL from server **749**. Thus, in get home URL process **801**, client module **702** obtains the home URL. Herein, a URL is an example of a specific embodiment of a resource locator.

For example, in get home URL process **801**, client module **702** obtains a home URL, such as

http://www.libris.com/airnet/home.cgi

and stores the home URL in the work space. The portion of the home URL, http:/www.libris.com, identifies a particular HTTP server, i.e, server **749**, on the world-wide web. The portion of the URL, /airnet/home.cgi, specifies a particular common gateway interface program within CGI programs **761**. The use of a URL pointing to a server on the world-wide web is illustrative only is not intended to limit the invention to applications on the world-wide web. In general, cellular telephone **700** obtains an identifier, i.e, a resource locator, of a home application on a home server that is executed by the server when the cellular telephone initially becomes active on airnet network **750**, and stores the resource locator in the work space.

Next in create HTTP request process **802**, client module **702** converts the URL in the work space to a HTTP request. For example, for the above URL, create HTTP request process **802** generates a method field, such as

GET/airnet/home.cgi HTTP/1.0

The GET method is part of HTTP. Thus, the format for the GET method is known to those skilled in the art. Also, this particular form of the method is used because a specific server connection is established by cellular telephone **700** and so identification of the server is unnecessary. Nevertheless, briefly, this command instructs server **749** to execute application home.cgi and execution of application home.cgi in turn results in generation of a home deck and a subsequent transmission of the home deck to cellular telephone **700**. HTTP/1.0 specifies the HTTP version used by client module **702** in cellular telephone **700**.

In addition to the method field, client module **702** in process **802** could also generate appropriate HTTP request fields to pass information to server **749** about the capabilities of client module **702**. The request fields can include information such as lists of the MIME content-types acceptable to the client; lists of data encoding types acceptable to the client; user authentication and encryption scheme information for the server; the length in bytes of the message being sent to the server; and the Internet mail address of the user accessing the server. This list of information is illustrative only and is not intended to limit the invention to the particular request fields described herein. Any request field defined by HTTP can be utilized by client module **702**. However, in this embodiment, the defaults are utilized and so no HTTP request fields are generated.

Typical HTTP methods that can be generated in HTTP request process **802** are a GET method for requesting either a TIL deck from server **749**, or execution of a common gateway interface program on server **749**; and a GET method request to a common gateway interface program with data, e.g., a query string appended to the URL. In either case, a URL is transmitted to server **749** within the particular message. After create HTTP request process **802** is complete, client process transfers to transmit request process **804**.

However, if the transmission control protocol is used instead of UDP, client module **702** would access a TCP module in establish server connection process **803** that replaced UDP module **714**. Since, in this embodiment, UDP is used, establish connection process **803** is enclosed by a dashed line in FIG. **8**A to indicate that this process is unnecessary when using UDP.

In establish server connection process **803**, a virtual connection would be made over CDPD network **710** between TCP interface module **714** and a TCP interface module in HTTP server **749** so that data could be transmitted between cellular telephone **700** and computer **743** using TCP, e.g., buffers to support data exchange are defined. The establishment of a TCP connection is well-known and so is not described further.

In FIG. **8**A, a dashed line connects establish server connection process **803** with establish client connection process **860**, that is also dashed, that is performed by HTTP server **749**. This indicates that both client module **702** and server **749** are required to complete process **803**.

When the TCP virtual connection is established, client module **702** transfers processing from establish server connection process **803** to transmit request process **804**. Similarly, server **749** transfers to request received check **861**, in which server **749** waits until a request is received. Establish client connection process **860** is not needed for UDP and so HTTP server **749** initiates processing in request received check process **861**. Process **860** is enclosed within a dashed line box to indicate that the process is used only for TCP.

In transmit request process **804**, the HTTP request is sent from the work area in telephone **700** to HTTP server **749**. Again, a dashed line connects process **804** of client module **702** to request received check **861** that is performed by HTTP server **749** to indicate that the check is dependent upon information from client module **702**. When the transmission of the request is complete, client module **702** transfers to response received check **806**.

Upon receipt and storage of the HTTP request, request received check **861** transfers to service request process **862** in which HTTP server **749** initiates service of the received request. In service request process **862**, if the HTTP request only seeks transfer of a static deck, HTTP server **749** retrieves the requested static deck from TIL decks **760**. Conversely, if the request requires server **749** to obtain data from the Internet or to append data to a particular file, server **749** launches the common gateway interface application addressed in the request, and passes the data in the HTTP request to this application for further processing.

For example, if the user of cellular telephone **700** requested a fax as in FIG. **2**F, the HTTP request identifies a common gateway interface application in CGI programs **761** that accepts as input data the telephone number and grabs the information to be faxed. The CGI application generates an e-mail transmission to the fax gateway. Similarly, for a stock quote, server **749**, in response to the HTTP request, launches a common gateway interface application that sends out a