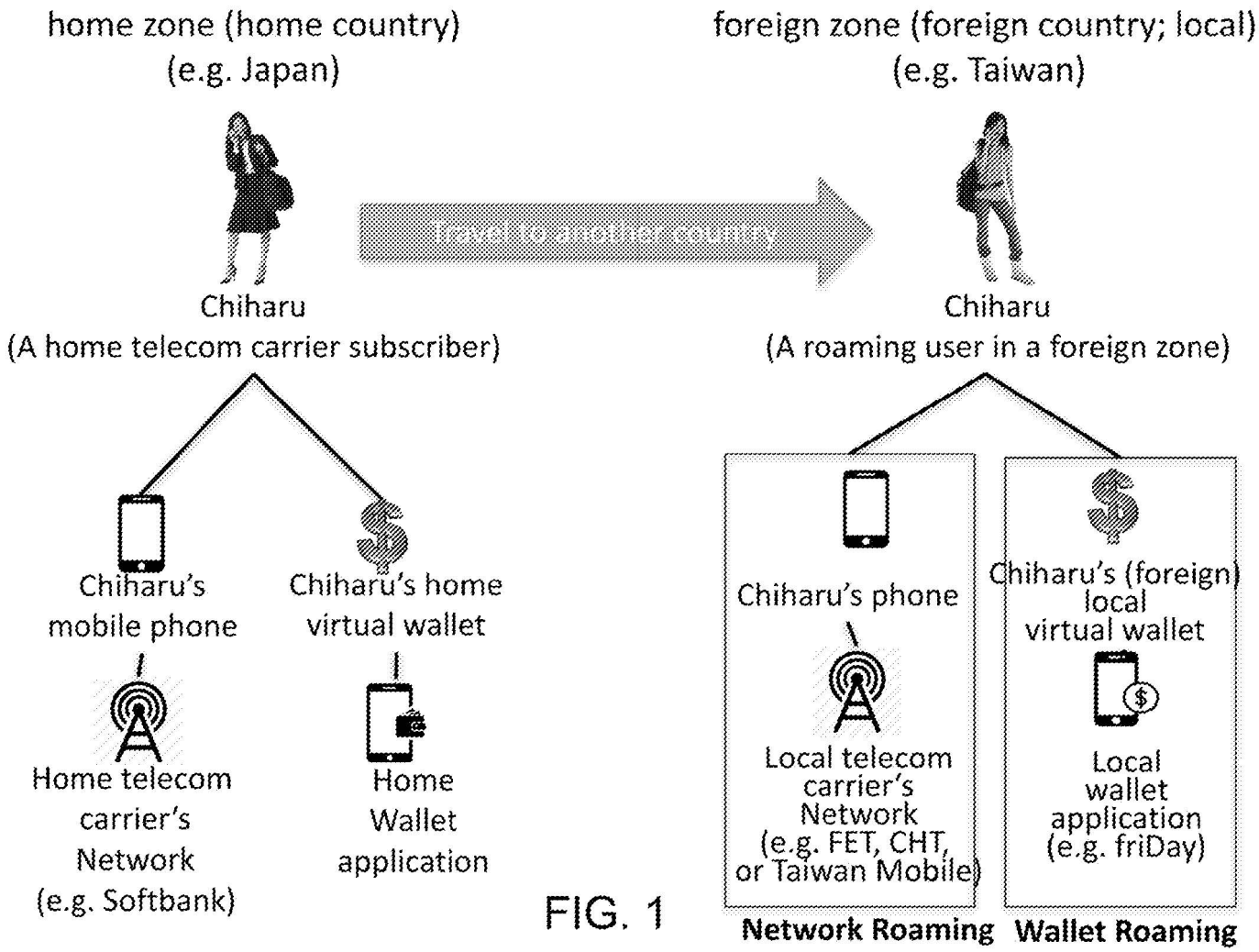

home zone (home country)
(e.g. Japan)
foreign zone (foreign country; local)
(e.g. Taiwan)
Travel to another country
Chiharu
(A home telecom carrier subscriber)
Chiharu
(A roaming user in a foreign zone)
Chiharu's mobile phone
Chiharu's home virtual wallet
Home telecom carrier's Network (e.g. Softbank)
Home Wallet application
Chiharu's phone
Local telecom carrier's Network (e.g. FET, CHT, or Taiwan Mobile)
Chiharu's (foreign) local virtual wallet
Local wallet application (e.g. friDay)
Network Roaming
Wallet Roaming

FIG. 1

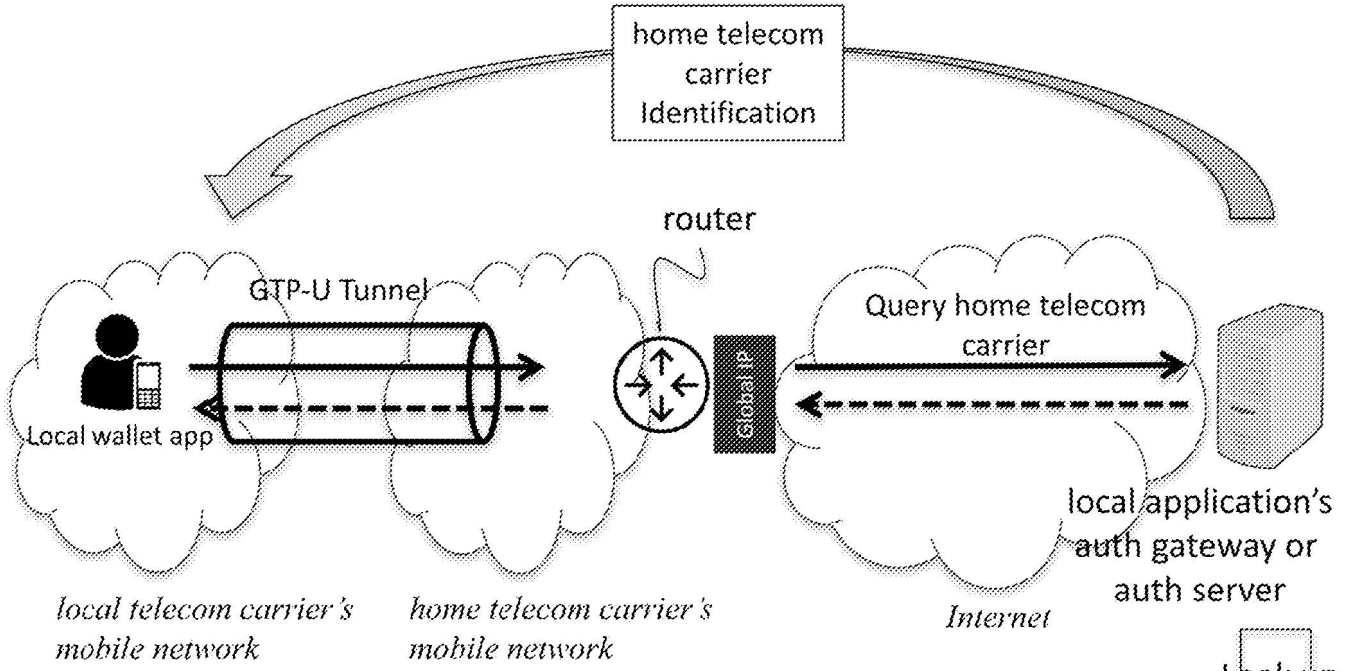


FIG. 2

global IP range table

Global IP Range	home telecom carrier
123.108.236.0/23	Softbank
126.34.0.0/20	FET
...	...

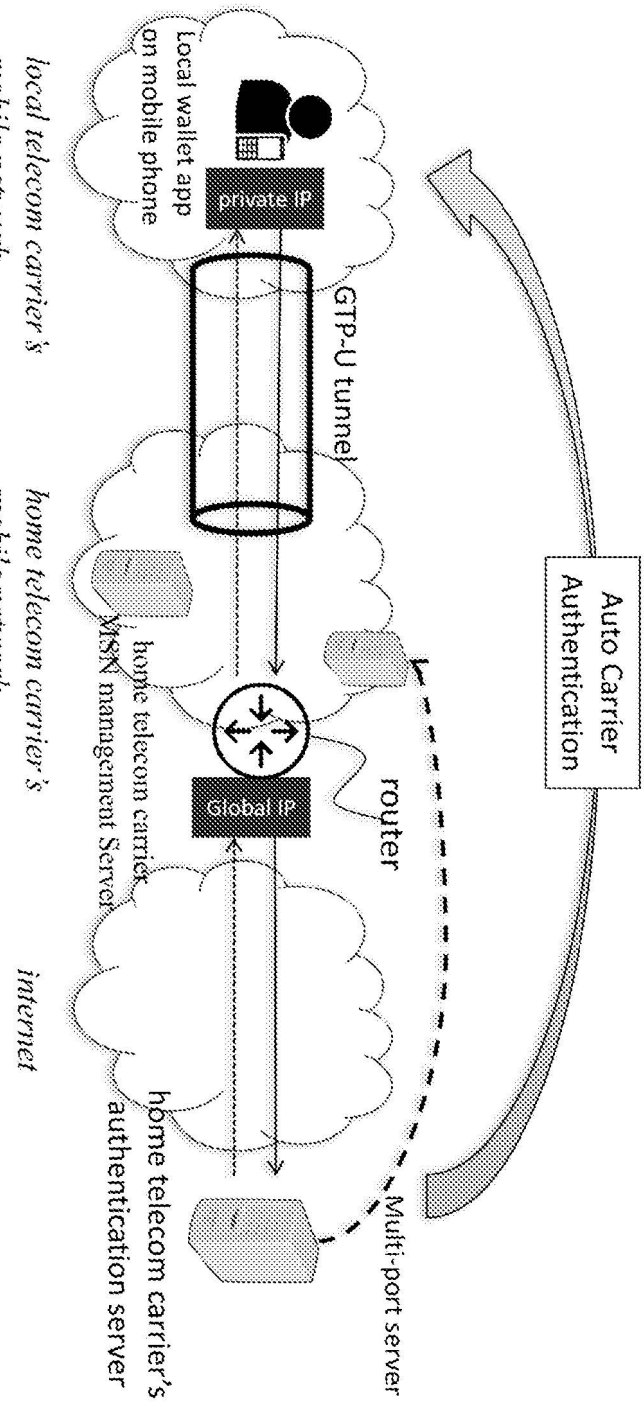

Auto Carrier Authentication
Local wallet app on mobile phone
private IP
GTP-U tunnel
router
Global IP
home telecom carrier's VISN management Server
Multi-port server
home telecom carrier's authentication server
local telecom carrier's mobile network
home telecom carrier's mobile network
internet

FIG. 3

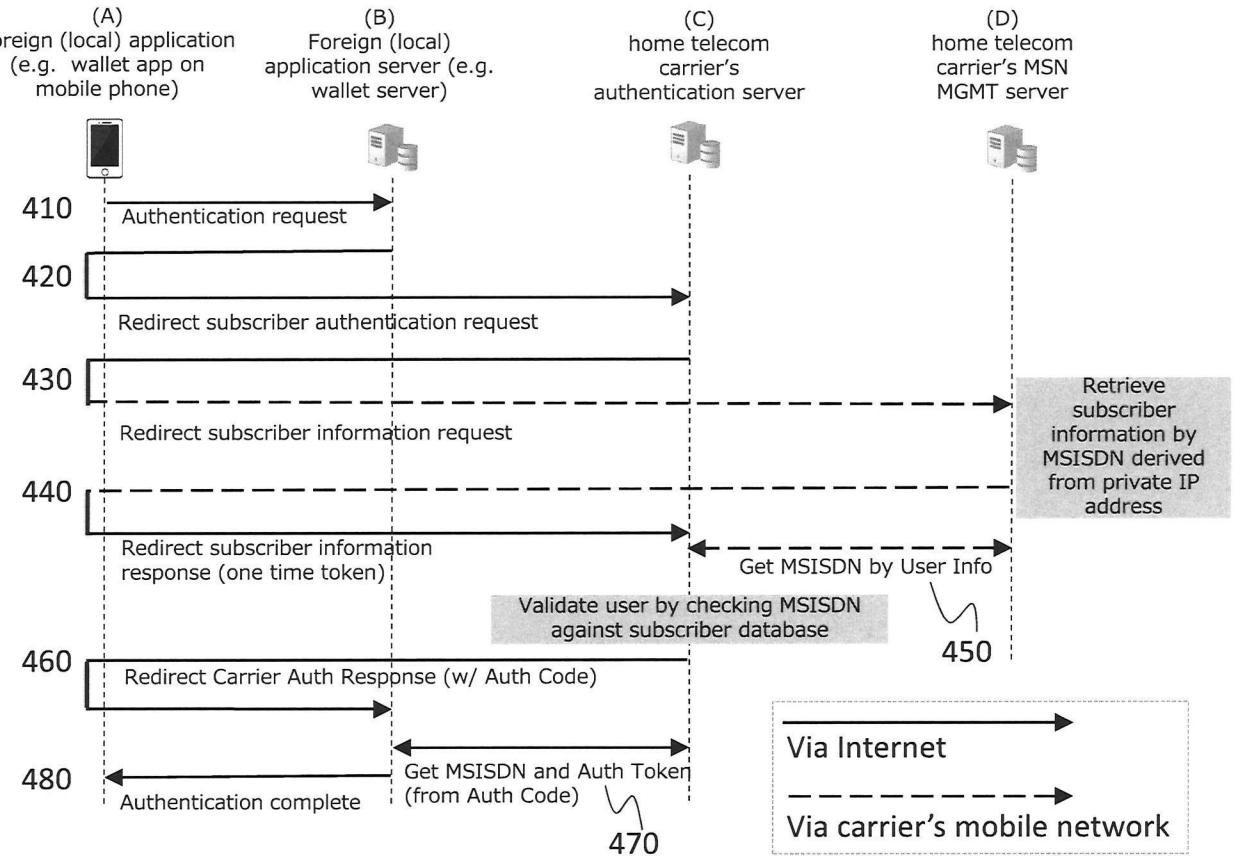

(A)
Foreign (local) application (e.g. wallet app on mobile phone)
(B)
Foreign (local) application server (e.g. wallet server)
(C)
home telecom carrier's authentication server
(D)
home telecom carrier's MSN MGMT server
410
Authentication request
420
Redirect subscriber authentication request
430
Redirect subscriber information request
Retrieve subscriber information by MSISDN derived from private IP address
440
Redirect subscriber information response (one time token)
Get MSISDN by User Info
450
Validate user by checking MSISDN against subscriber database
460
Redirect Carrier Auth Response (w/ Auth Code)
480
Authentication complete
Get MSISDN and Auth Token (from Auth Code)
470
Via Internet
Via carrier's mobile network

FIG. 4

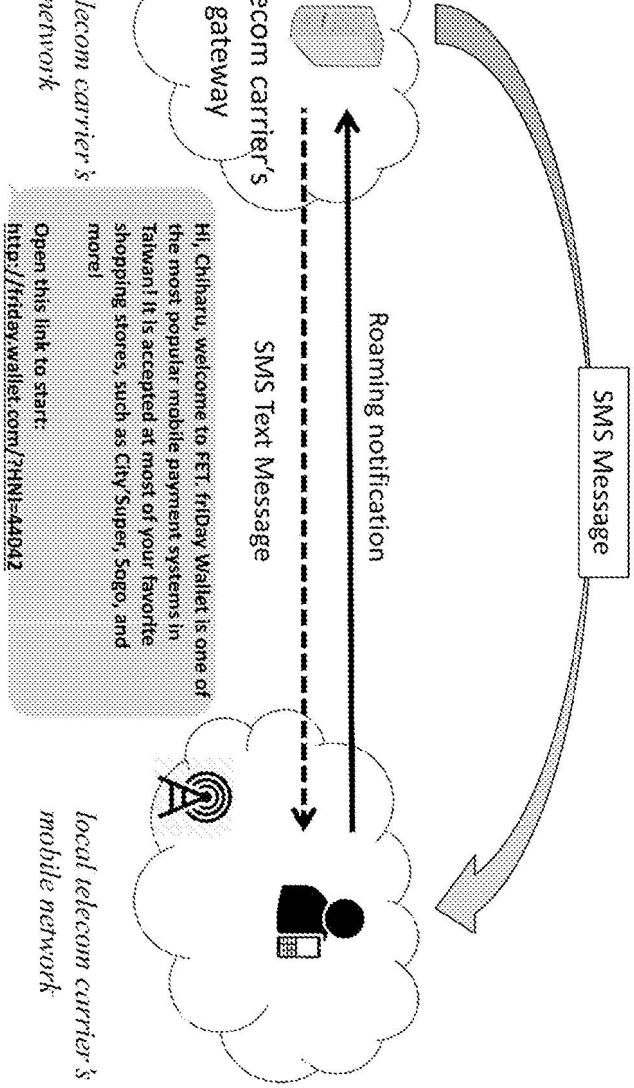

SMS Message
Roaming notification
SMS Text Message
home telecom carrier's
SMS gateway
home telecom carrier's
mobile network
Hi, Chiharu, welcome to FET. friDay Wallet is one of the most popular mobile payment systems in Taiwan! It is accepted at most of your favorite shopping stores, such as City'Super, Sogo, and more!
Open this link to start:
http://friday.wallet.com/?HNI=44942
local telecom carrier's
mobile network

FIG. 5

local
wallet app
User ID &
Password
Local
wallet server
User ID &
Password
home telecom carrier's
authentication server

FIG. 6

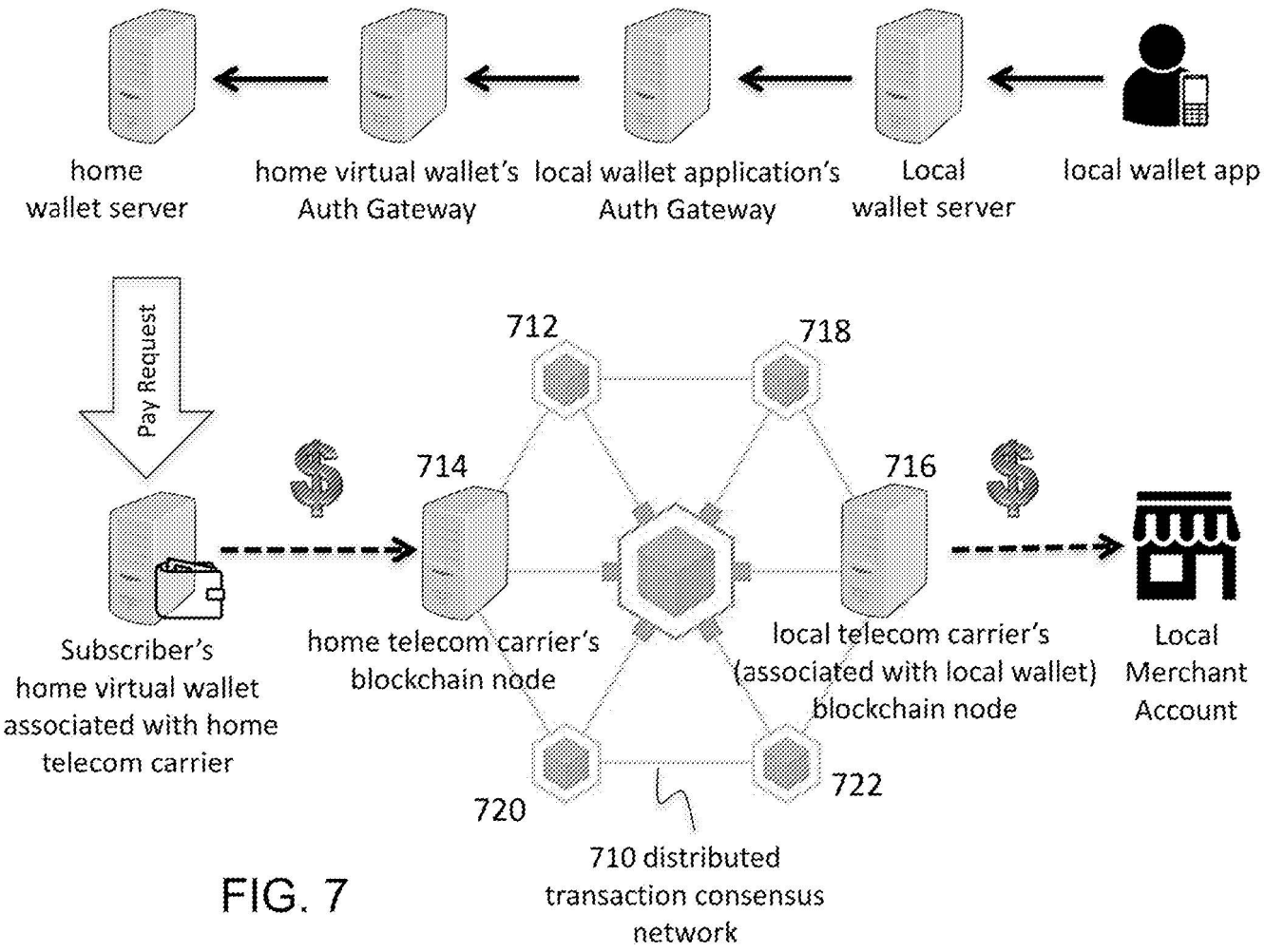

home
wallet server
home virtual wallet's
Auth Gateway
local wallet application's
Auth Gateway
Local
wallet server
local wallet app
Pay Request
712
718
714
716
Subscriber's
home virtual wallet
associated with home
telecom carrier
home telecom carrier's
blockchain node
local telecom carrier's
(associated with local wallet)
blockchain node
Local
Merchant
Account
720
722
710 distributed
transaction consensus
network

FIG. 7