

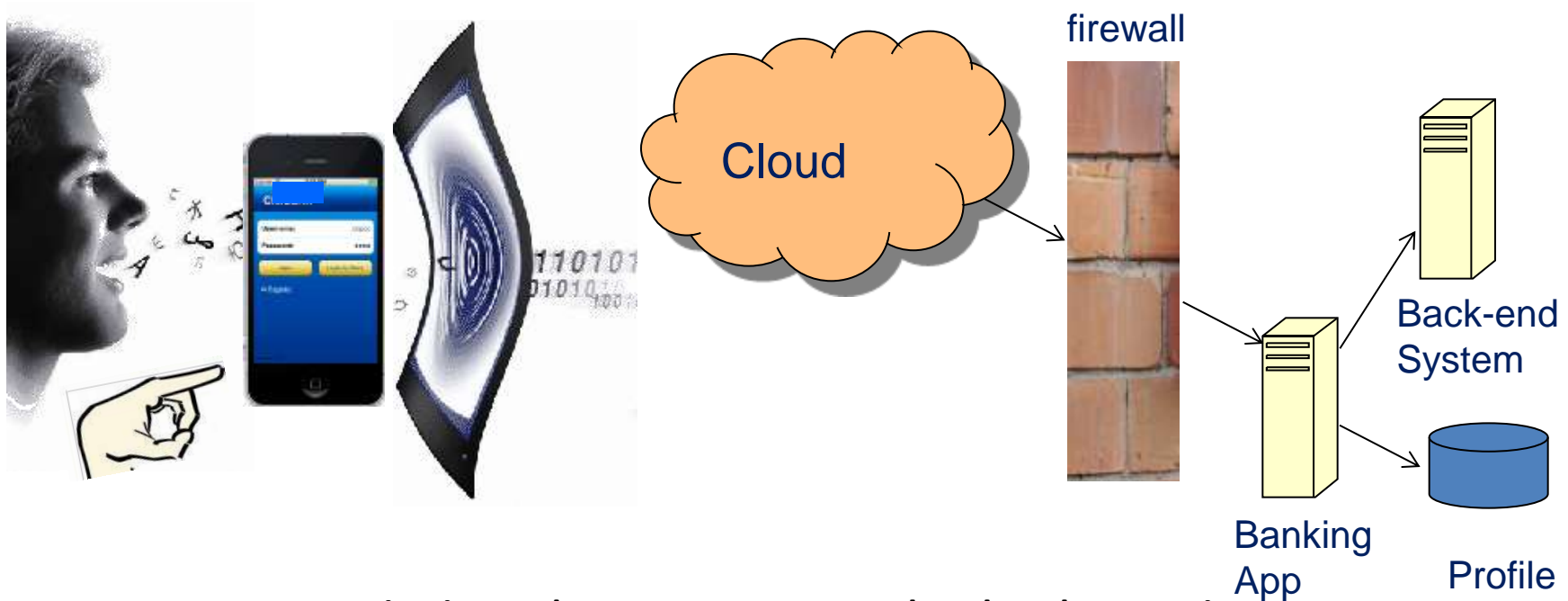
Multimodality in Mobile Banking

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Outline

What is Multimodal Mobile Banking?
High Level Needs Assessment
Multimodal User Interface Design
Biometrics
MultiFactor Authentication
Q/A

What is Multimodal Mobile Banking?



Transparent Navigation and Data Entry => UX and Back End Integration

Banking Transactions by speaking or touching a Smartphone,
Then viewing or hearing the results of the dialog

Biometric Authentication => Non-intrusive, transparent Security

Voice Recognition
Facial Recognition

Mobility and Multimodality – High Level Needs Assessment

High-Value Services for Smartphone Users

Entertainment

Location based-services

News and sports updates

Social Networking

Transaction-based services => banking

2012 - 24% of adults used mobile banking

2013 – 35% of adults used mobile banking

Combined Modes on a Smartphone

Existing web page (GUI) or IVR apps (VUI)

Native Features

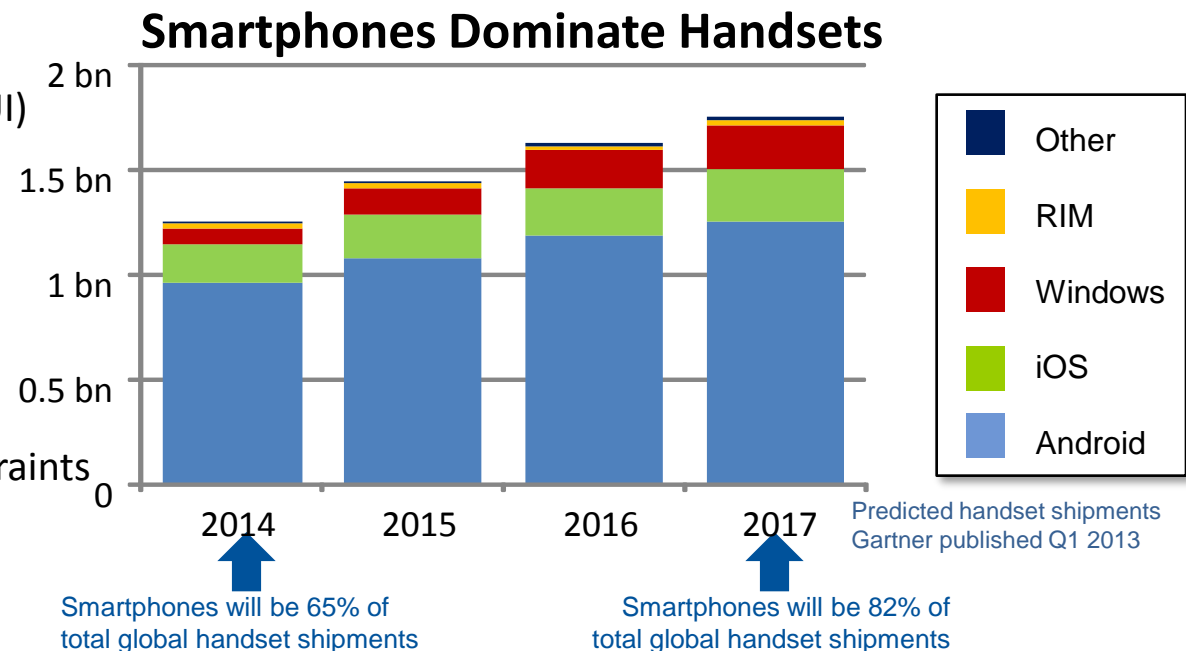
Fixed set of transactions

Strengths and Challenges of a MMUI

Reference application to identify issues

Cognitive, Behavioral, Kinesthetic constraints

Error detection and Correction



Prof. Dan Siewiorek of CMU shares his vision of Smartphone evolution.
(IEEE Spectrum, Sept 2012, *Generation Smartphone*)

Multimodal Mobile Banking - Use Cases

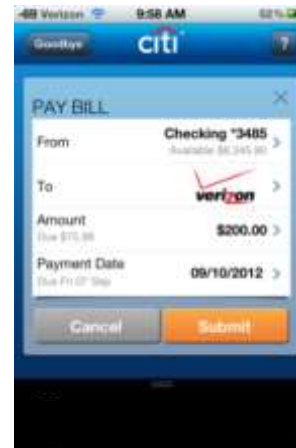
“Account balances”



“Show me my 5 most recent transactions.”

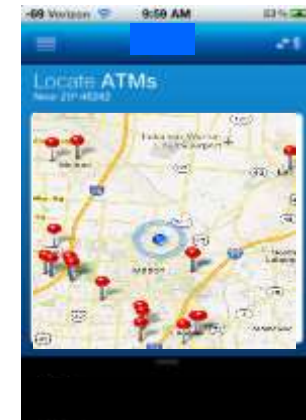


“Pay \$200 from checking to my Verizon bill next Friday”



Typical Use Cases:
 Show Balances
 Recent Transactions
 Payment and Transfer
 Find ATM
MMUI = GUI + VUI
 Say what you want,
 correct when needed.

“Where is the nearest ATM?”



Toolkits and Development Environments

Rapid prototyping, Usability Testing

Flexible Transaction Flow – customer control of alternative paths

Compendium at http://www.avios.org/app_dev.htm

Mobile Frameworks

Browser-based languages (HTML5, JQuery, JQuery Mobile, Java Script)

Hybrid / Cloud Solution – Application on server, rendered on Smartphone client

Nuance NINA (Android and iOS) starter kit + demo applications

Native Features through Cordova (PhoneGap) or Voxeo Tropo

Multimodal Banking Transactions – Performance Analysis

“Transfer \$100 from my savings to checking on Friday”

Tablet



14 steps
(if new date)
9 steps
(if today's date)

Multimodal



3 steps

Time and Effort Comparison

Fitt's Law => Time for Movement (speed, accuracy trade-off):

$$T \sim \log_2(2d/W)$$

close, big targets are reached faster than small targets farther away

service	Steps			time (secs.)	
	Web	Tablet	MM	Tablet	MM
Account Balance	2	1	1	0	0
Recent Transactions	2	2	2	1.3	1.5
Make a Payment	13	14	3	23.1	5.8
Find an ATM		1	1	2.1	1.5
[Transfer Funds]	13	14	3	23.1	5.8

Conclusion:

Highest payback for voice in multi-step transactions.

Key Value Drivers:

- Ubiquity of Smartphone –
- Anywhere, anytime –
- Ease of use, reduced errors –
- Consistent UI/UX –
- Differentiation–
- Shorter transaction time –
- Better self service -

- Untapped Market
- Customer retention
- Customer Satisfaction
- Faster Time To Market
- Market capture, rewards, cards
- Lower operation costs
- Efficient utilization of back-end resources

Multimodal Mobile Design - UI/UX Mental Model

Terminology

Common visual layouts, verbal consistency, reduced clutter, branding
Colloquial Grammar, sentence structure, reference (“this one”)

Increased Complexity => Expectation, Cognitive Load, Learning Transfer

Utilize modal preferences – say what you want, read the response
Follow Natural Conversation and Behavioral Flow, attention and memory
User Control – monitor what is done most often, and how; “stickiness”

Dialog Flow

Security - seamless
Streamlines - “jump” vs multiple steps
Fewer errors since fewer GUI navigation steps

Error Correction

“Breadcrumbs”, Detection, highlighting
Alternative modes of content entry (multimodal)



Authentication Biometrics – High Level Description

Fingerprint - Image

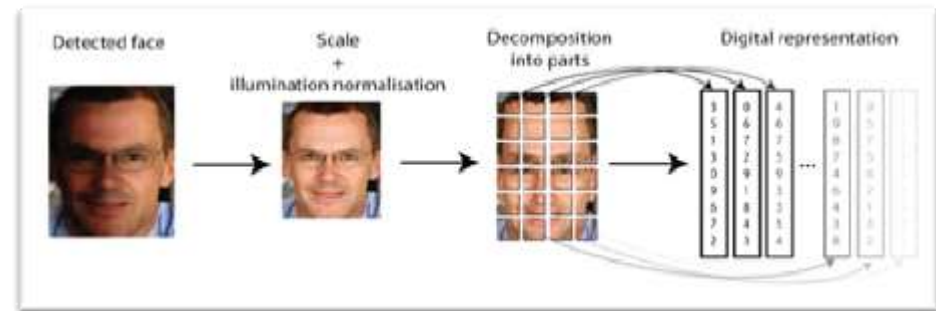
PC and smartphone - swipe/scan, explicit, fussy, spoofable
 1-1 or 1-from-N match to userID, or identify from a large DB

Signature / Gesture - Accelerometer

Smartphone - cadence, [Android prelim. investigation]

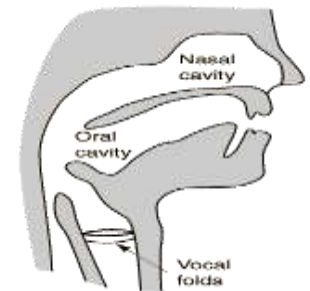
Face - Image

Transparent - non-intrusive, no PIN or KBA
 Performance authorize <1sec, EERate <1.5%
 Consistent UI - any device, any channel
 Easy enrollment - fast, effortless

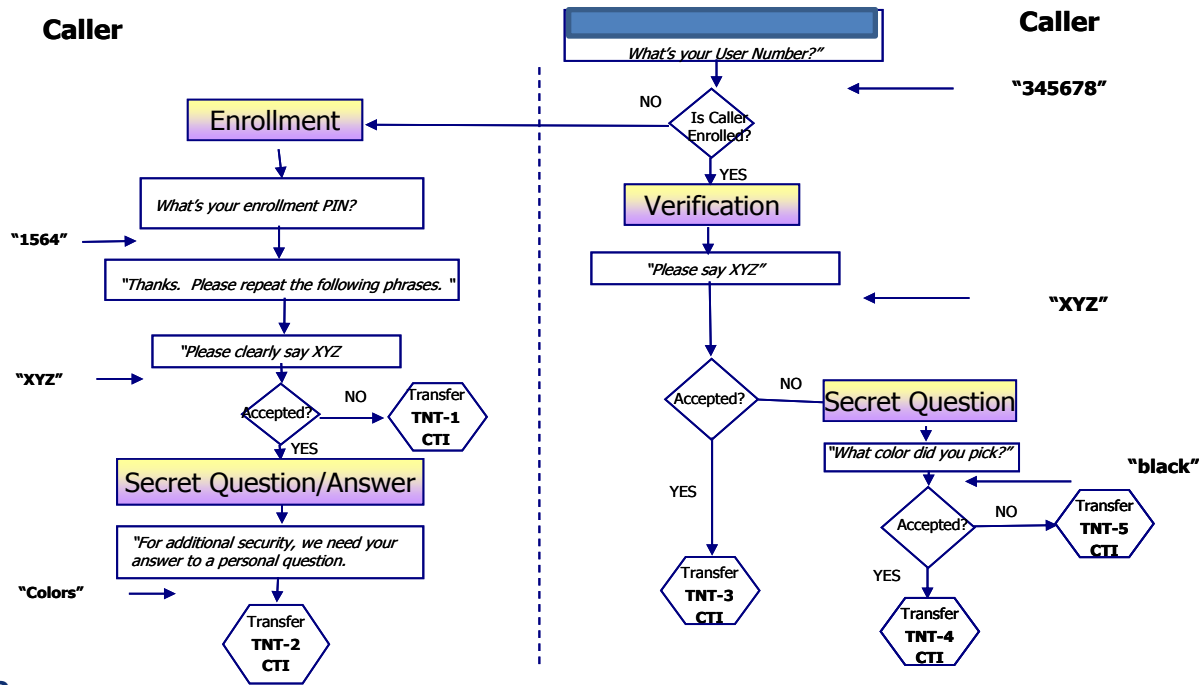


Voice - .wav file

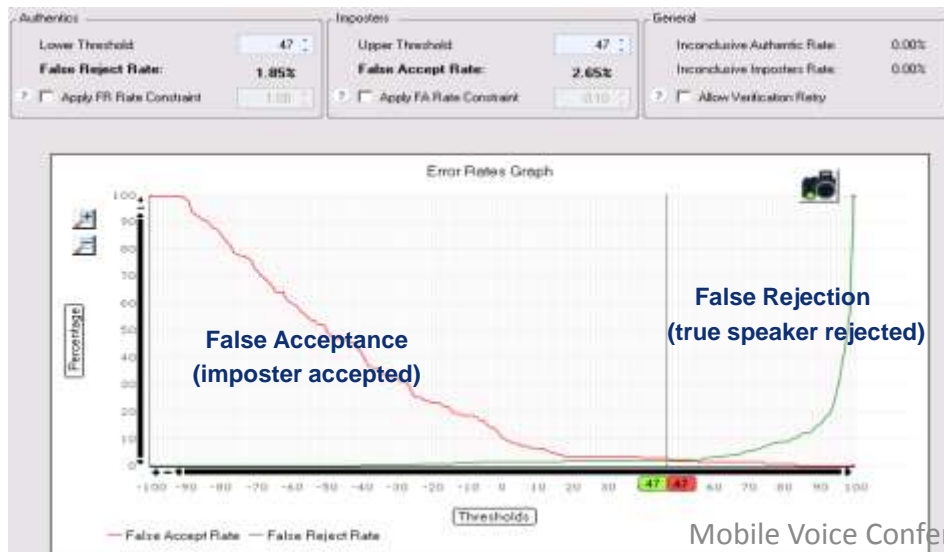
Reduced Fraud - increased security, EERate <2%, FA to .1%
 Multiple Factors - initial and within, explicit or transparent
 Multi-channel - IVR, web, mobile phone, VoIP
 No device costs - server license fee, Web Services APIs
 Language Independent - international, personal passphrase
 Tuning Tools - reduced operations cost, browser-based tools



Voice Authentication – Enrollment and Verification



Evaluation Studio



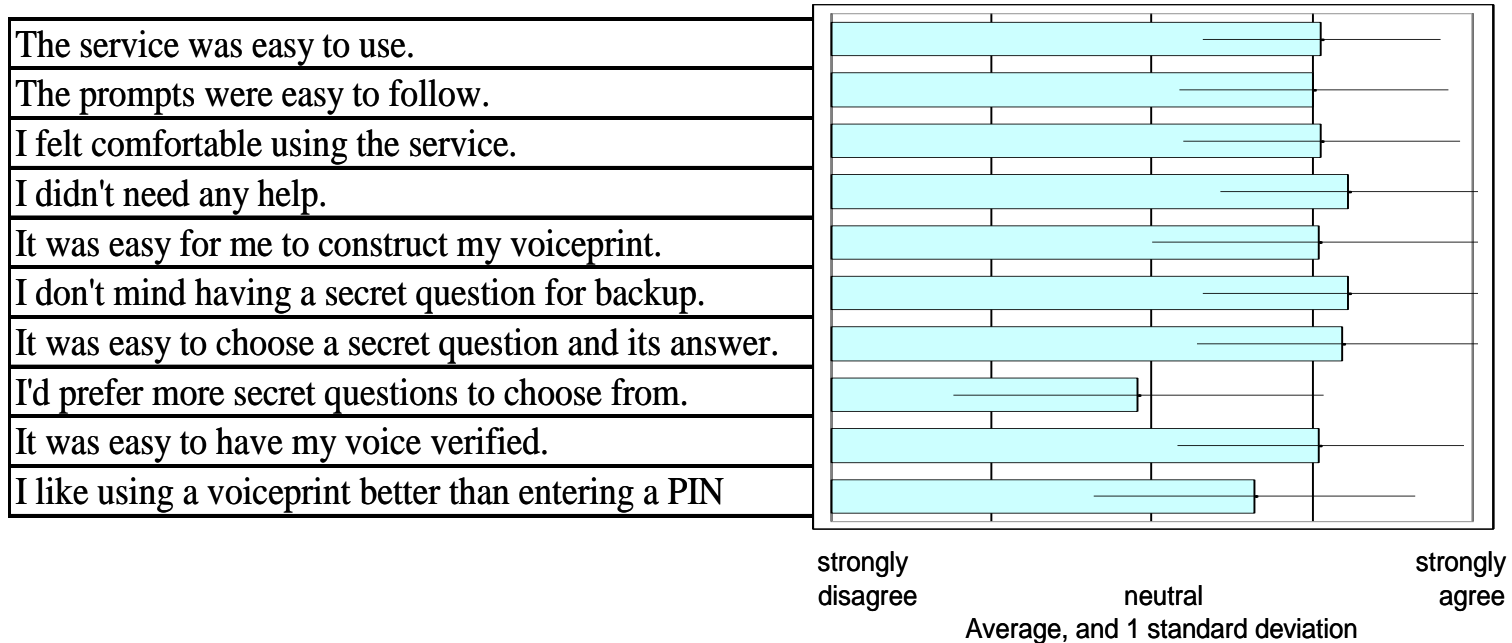
Easy to Enroll
 Easy to Verify
 Set Threshold as trade-off
 Extra Factor(s) if needed

Voice Authentication – Measuring User Experience

Preference Scores

A questionnaire is given after the Trial.

The 5-Point Mean Opinion Score indicates agreement with the statement,



Interpretation

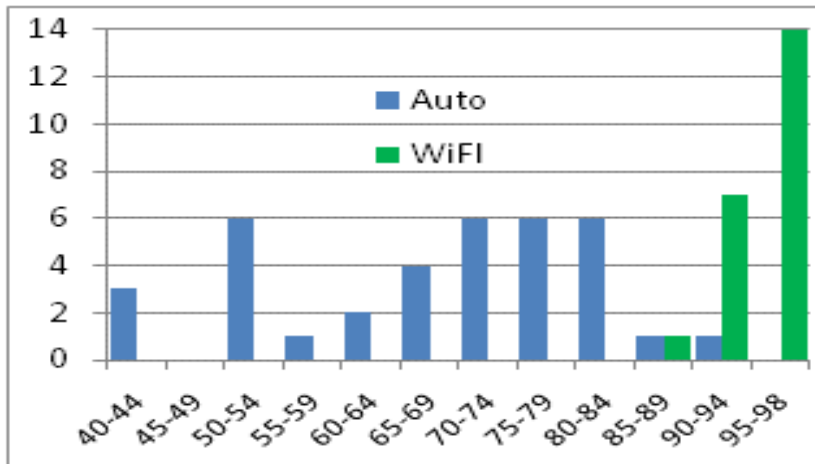
- easy to use, comfortable, and users didn't need any help
- it easy to construct and use a voiceprint.
- there is no issue with a Secret Question, but do not have more than 5 alternative questions
- a voiceprint is slightly preferred over a PIN.

VA & Geolocation- Multi Factor Authentication

Route



Confidence Score



Mobile (Automobile) calls

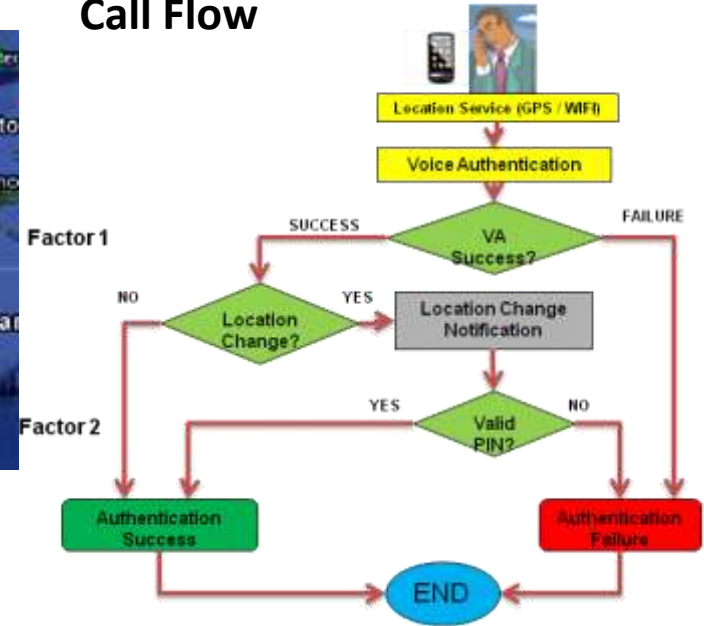
WiFi calls

1900 miles - Some network and road effects

11 mobile sites - lower scores, lower SNR, more variance & rejections

1 fixed site - higher scores, no rejection

Call Flow



Value Drivers

Security

- MFA - fusion of 2 Factors,
- Specify Decision Rules - Site, Country, Business, etc.

Customer Focus

- Minimal UI/UX complexity (once, at initial step)
- Transparent geo (no user interaction)

IT Efficiency

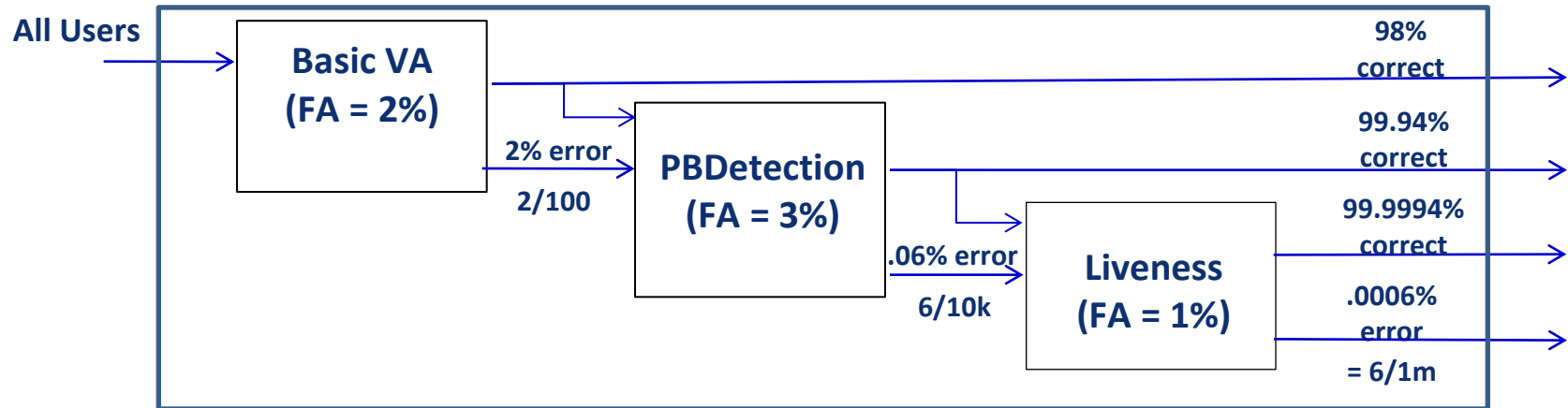
- Hybrid with Native features of smartphone
- Geo-centers and geo-fence distances are tunable
- No delay for geolocation information
- No 3rd party components, integration, tuning, support

Multi-Factor Authentication - Multiple Voice Stages

Each stage is an independent test, and effects treated as independent events.

More tests reduces the False Acceptance, increases security.

Order of modules must be seamless



Other Authentication Issues:

MFA fusion rules (fuzzy logic, linear wts.)

Other Factors- Credit Card PIN, Geolocation

Other VA processes: Directed Digits (like, OTP) with ASR for digits and VA for speaker

Security Levels – Voice compared to Data

Risk Level	permissions	Data	Voice
1	Basic Info: acct balance, order checks, stop payment, pay bill	Password, PIN	PIN & voiceprint
2	new payee, withdrawal, transfer change PW, change address	Knowledge-Based (secret Q/A)	Liveness Detection Device or geolocation
3	High risk transfer, trades, loan payments	OTP, SecureCard	softwareOTP = Random Numbers

Conclusion

Multimodal Mobile Banking and Mobile Wallet prototypes are being tested to identify strengths, mitigate confusions, and seamlessly direct the user back on the success path of Digital Banking.

Questions??

Thank you



Dr. Matthew Yuschik designs, develops and tests Multimodal Mobile Banking UX/IU for Citibank's R&D group. This involves voice navigation, voice authentication, transaction analysis, and usability. He field-trialed a Multimodal Call Center Workstation in the US, and developed voice-activated voice mail for 7 European wireless providers. Matt has 9 patents, with 3 pending,. He has been on the AVIOS Board for 8 years, and is currently the Treasurer..

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