Building common ground by sharing mobile device context

Vassilis Kostakos, Eamonn O'Neill & Anu Shahi

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Motivation

- People who meet (for the first time) establish who and what they have in common
- Here we describe a mobile application that facilitates this process
- This shared knowledge, *common ground*, is used to frame our communication
- Humans are very good at this

Getting it wrong

I say Who's on first, What's on second, I Don't Know's on third.
Well then who's on first?
Yes.
I mean the fellow's name.
Who.
The guy on first.
Who.
The first baseman.
Who.
The guy playing...
Who is on first!
I'm asking YOU who's on first.
That's the man's name.
That's who's name?
Yes.
Well go ahead and tell me.
That's it.
That's who?
Yes.

-"Who is on first"

Overview

- Related work, shortcomings and issues
- Describe common ground
- Our mobile application
- Evaluation
- Conclusions

Related work

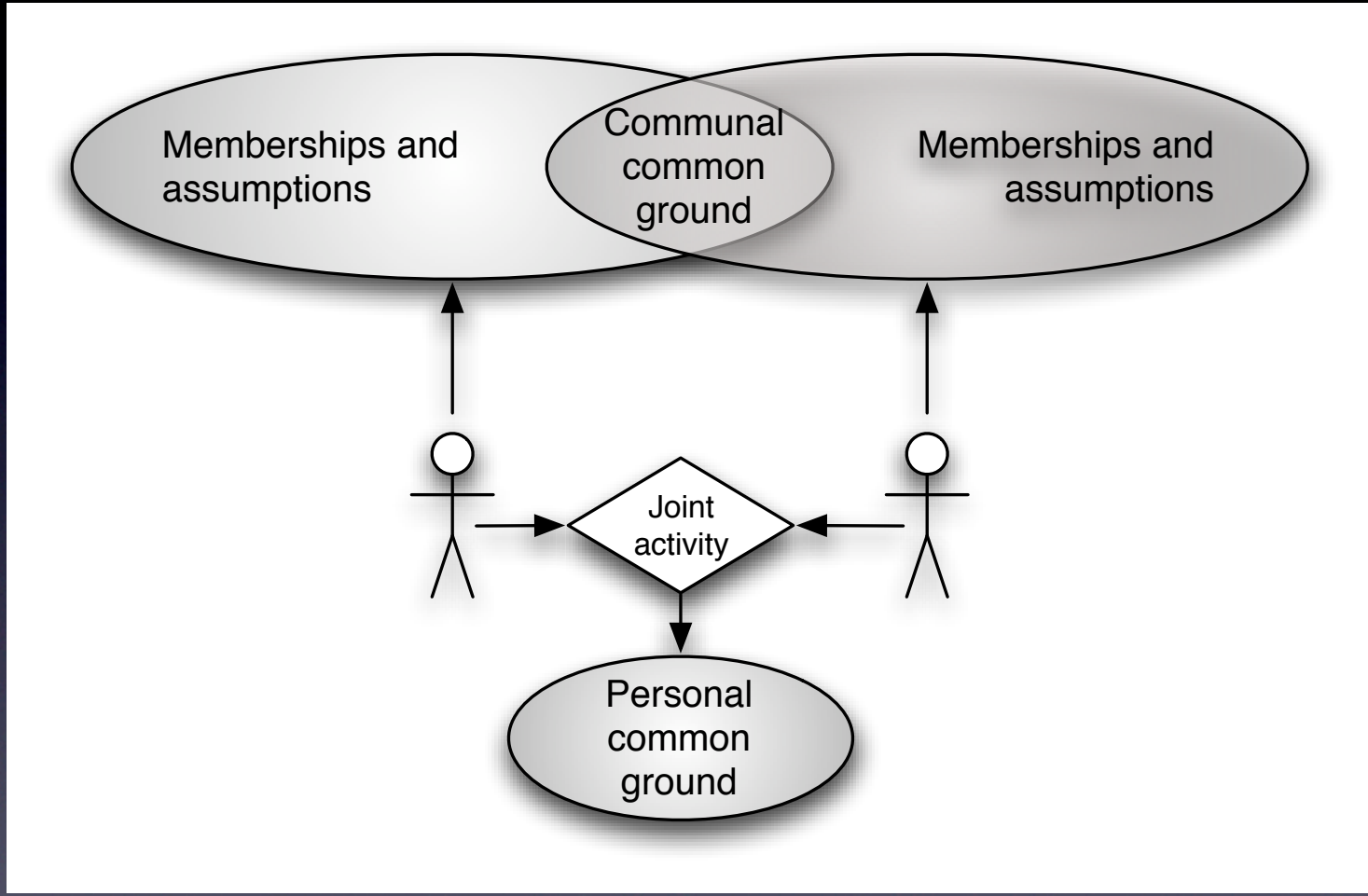
- Various websites: Friendster.com, Match.com
- Jabberwocky, Telelogs, ContextContacts, BlueAware, Nokia Sensor, Bluedating

Issues with existing work

- Complexity of technology acts as a barrier
- Irrelevant information being broadcast by users (potential for abuse)
- Outdated profiles
- Inconsistent levels of user awareness
- Social awkwardness, mismatch with human behaviour

Common ground

- Introduced by Stalnaker (1978), and refined by Clarke
- Shared knowledge, assumptions and beliefs
- Established by
  - evidence of common membership of communities
  - joint perceptual experiences and actions



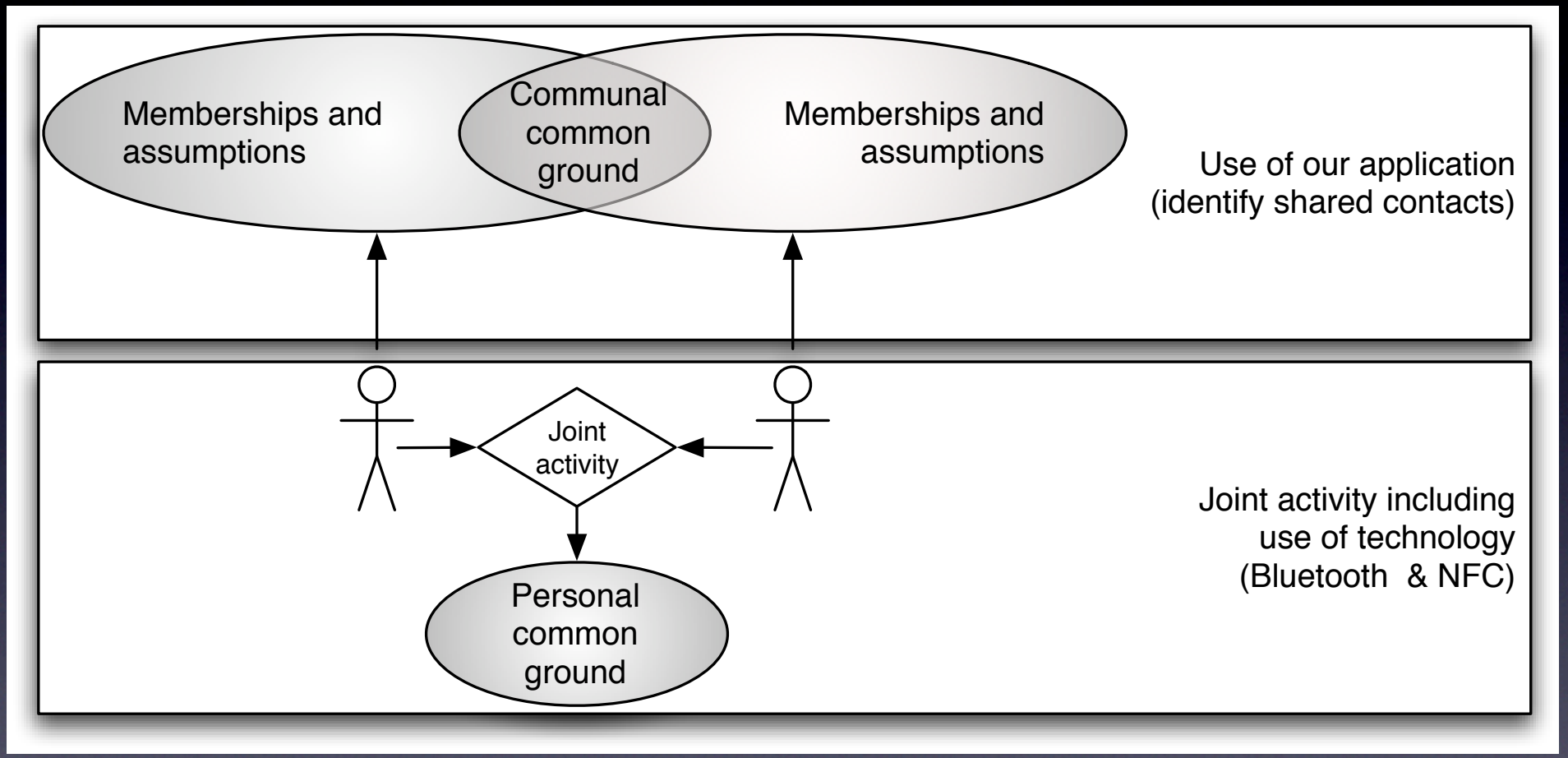
Common ground

Our application

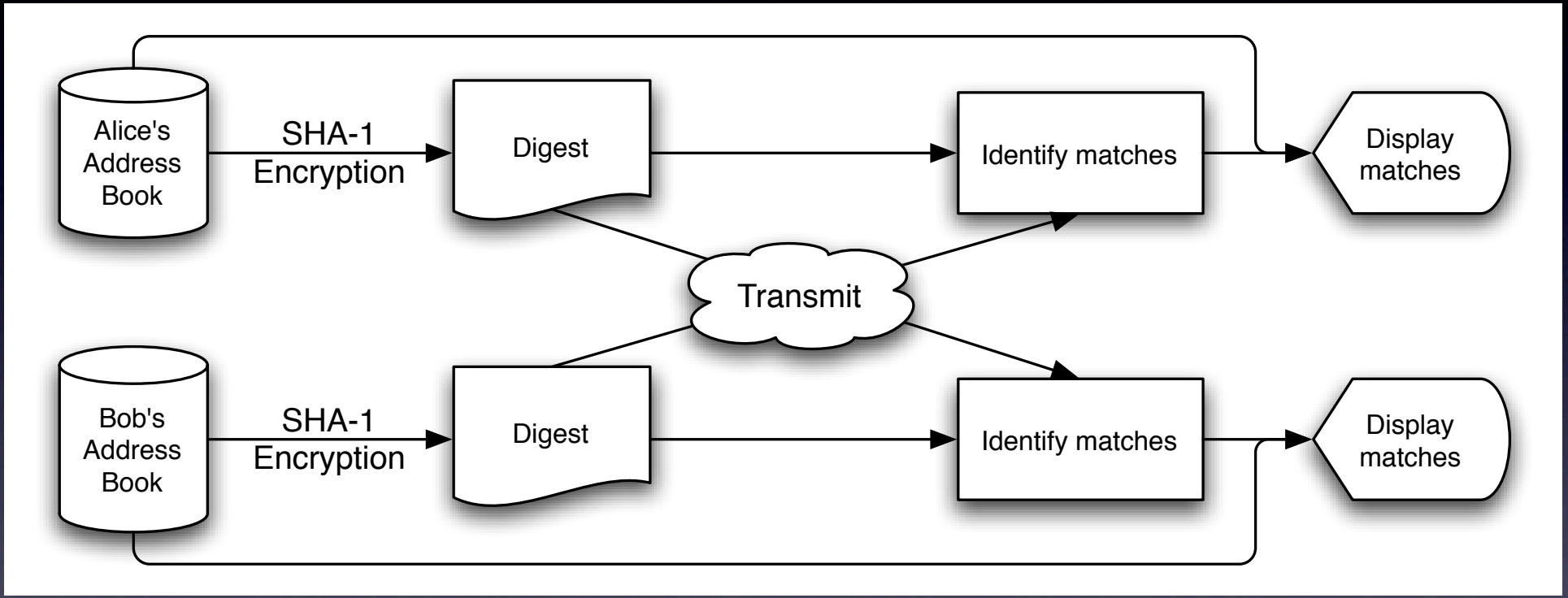
- Identify common address book entries
- Address books describe who we know (community membership: family, friends, colleagues)
- Provide evidence of common membership
- Less scope for abuse
- Information is updated

Technological affordances

- A number of communication technologies could be used
- Bluetooth and NFC are similar enough and distinct enough to compare:
- Both are proximity-based (rather than location-based)
- With Bluetooth our system can be the first point of contact; NFC prevents this



Our application



How does it work?

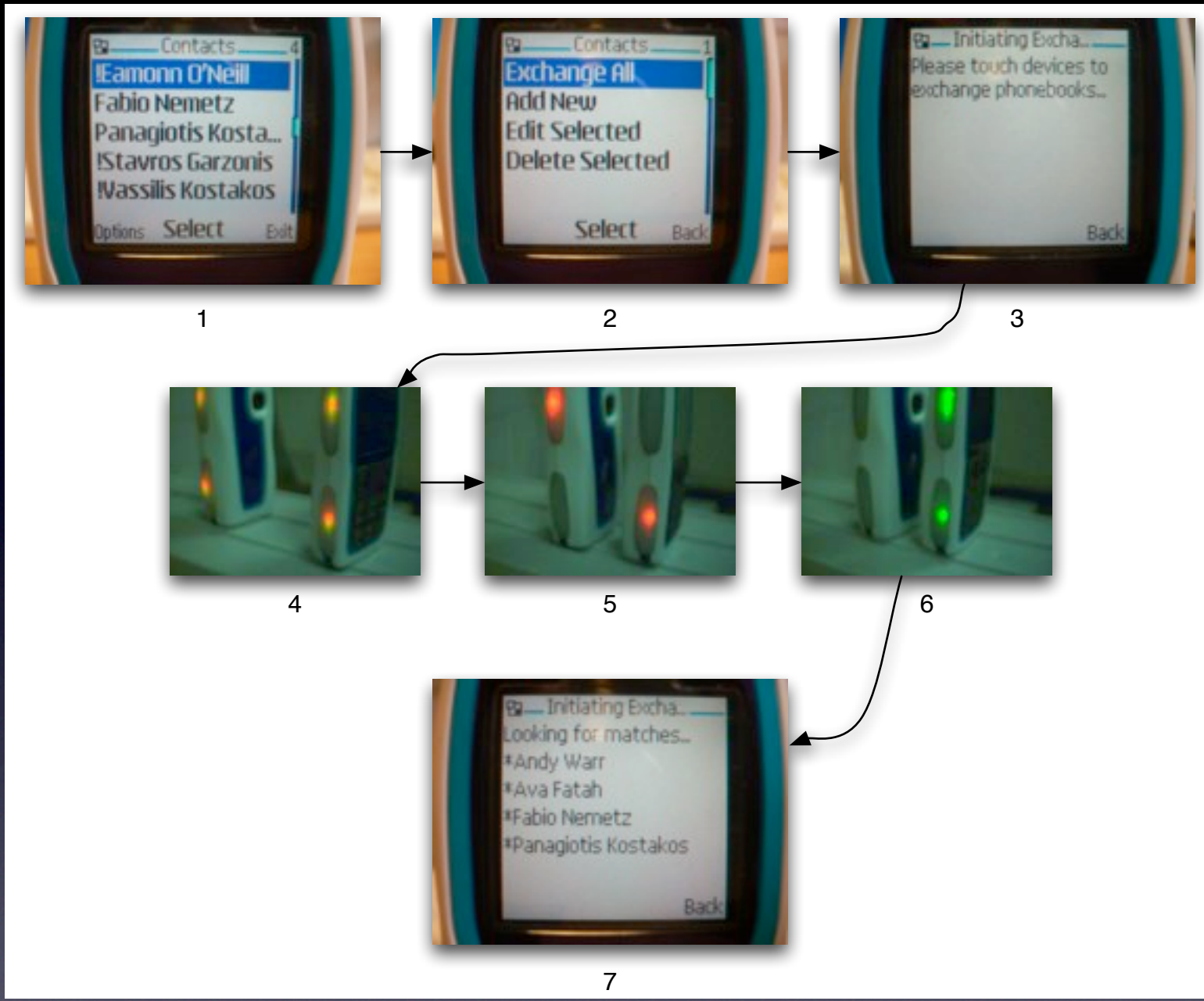
Implementation

- No phone with both Bluetooth & NFC
- Nokia 6680 (Bluetooth), Nokia 3320 (NFC)
- Developed using J2ME, mpowerplayer, Nokia NFC SDK
- Interface components are identical, but are rendered differently on the two phones

Interaction design

- Explicit input from both users is required
  - Avoid accidental (or malicious) exchanges
- An exchange is always two-way
  - Reciprocity of social interaction
- Some entries can be "hidden"
- Received digests are discarded
  - Ephemeral nature of social interaction

Bluetooth implementation



NFC implementation

Security issues

- NOT SECURE!
- Small domain => Weak hashing
- Malicious users
- This problem is known as "Private Matching"
- Approaches:
  - Commutative encryption: $F(G(x)) = G(F(x))$
  - Homomorphic encryption:
    Given $G(m)$, $G(n)$ => $G(m+n)$

User study

- Limited study with 5 participants
- Probe aimed at getting initial responses
- Participants were trained on both systems and used both systems
- Comments before, during and after the trials were recorded

Results

- First reaction: "Can i give my phone number?"
- All participants mentioned that identifying common contacts is something they often do
- They wanted to try it out with people they already know (friends, colleagues)
- NFC preferred for face to face interaction, Bluetooth preferred for "exploring"

Results

Bluetooth

- Useful for meeting strangers
- Users reluctant to respond to strangers
- Does not give away physical location of user
- Weak joint experience
- Request-reply model

NFC

- Limited usability when using the phone
- Preferred for face to face interaction (synchronous reciprocity)
- Strong joint experience
- Symmetric model

Conclusions

- Identifying shared contacts was intended to provide evidence of communal common ground
- But this only works when people are co-present, so that they can verify that "I know that you know that I know...." *ad infinitum*
- NFC requires co-location
  - better basis for this *ad infinitum* process

Conclusions

- NFC requires intimate, synchronous, reciprocal physical actions
  - stronger basis for personal common ground
- When using Bluetooth (and not co-present), you know you share contacts, but with whom?
  - No common ground established

Ongoing work

- Security
- Thorough evaluation
  - Realistic environment, users' actual address books
  - New acquaintances vs. strangers
- Exchange additional information
  - bookmarks, music, calendar?

Thank you

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