



Research Consortium in Speckled Computing

Localisation using optical communication

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- Localisation
 - Distributed + homogeneous + specks + mobility = difficult
- Current algorithm
 - Works well
 - Requires orientation sensors on each speck
- Impact of polarisation
 - No longer need orientation sensors

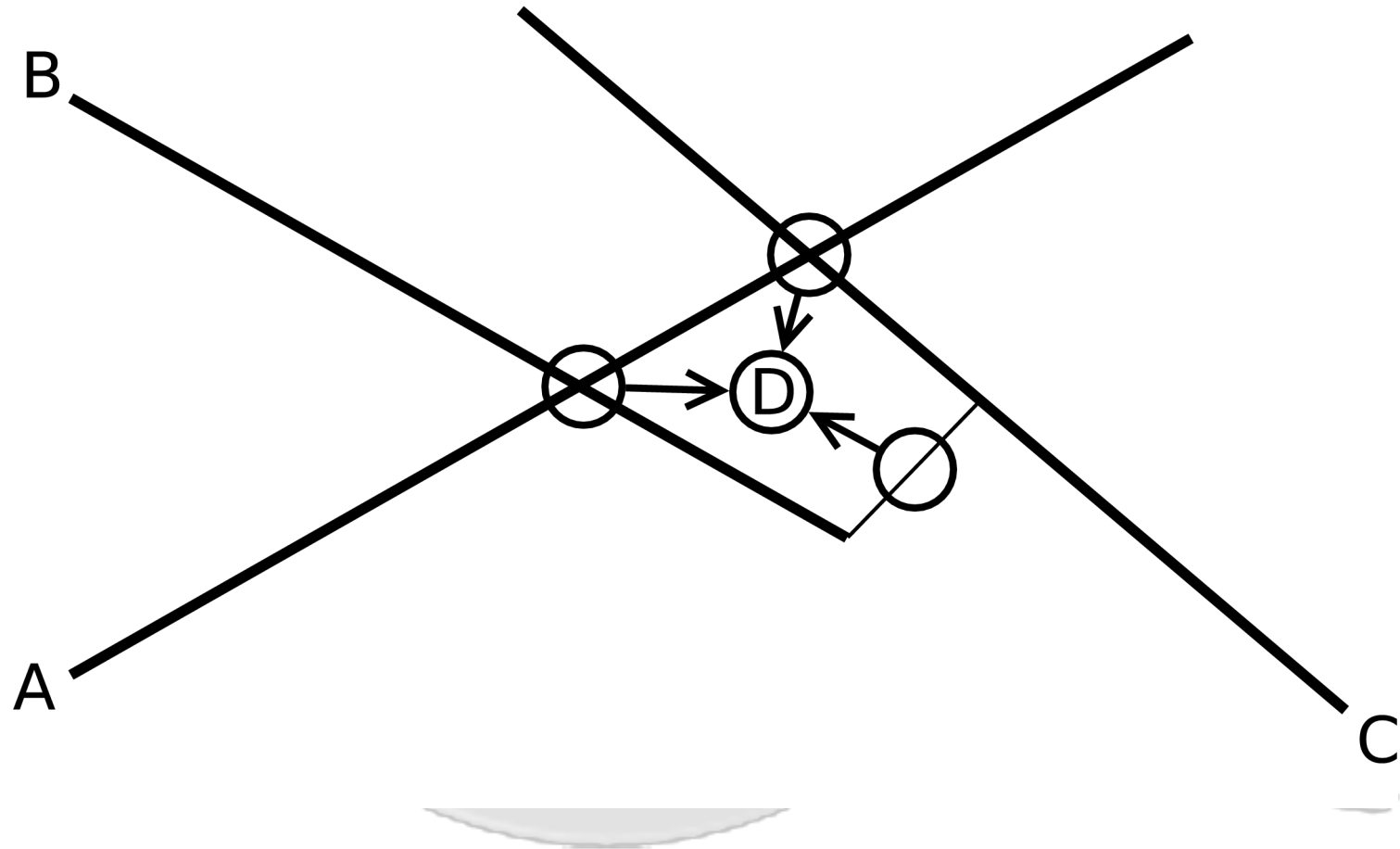
Localisation

- Location data is extremely useful
 - context for sensed data
 - routing
- Difficult in SpeckNet environment
 - Distributed
 - Homogeneous network of feeble nodes
 - Failure tolerant
 - Ease of deployment
 - Mobility

Direction sensing algorithm

- Works well (more later)
- Specks must sense the direction to their neighbours
 - 1) Sense the direction of an incoming transmission
 - 2) Sense their own orientation, relative to some common point
- Provided by:
 - 1) Optical communications
 - 2) Orientation sensor (see Orient3)

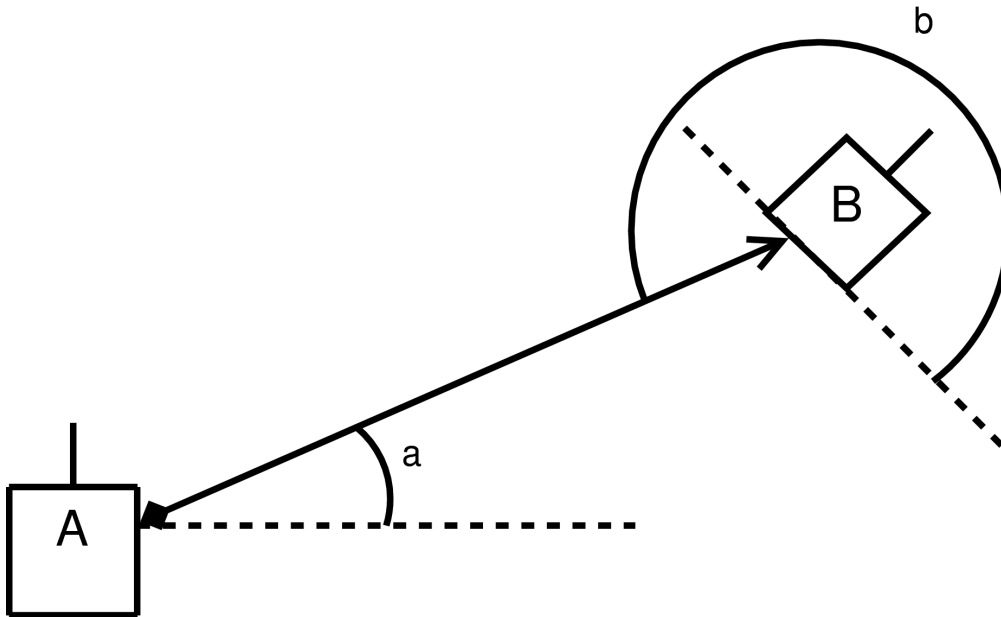
Algorithm premise



Orientation requirements

- Can be relaxed in 2D deployments
- Specks can transmit in certain known directions
 - transmit their position, orientation, transmission direction
- Specks can receive from certain known directions
 - and thus work out their orientation relative to the sending speck

2D networks



I have received the endpoints of line segment S, so my location must lie somewhere on its length. The transmission's incident angle was b , so my orientation is...

I am transmitting at angle a , my position is (x,y,z) , my orientation is α degrees: thus my transmission will travel on the line segment S. I transmit the endpoints of S.

3D networks

- System breaks down
 - a speck's roll angle relative to the transmitting speck is unknown...
 - ...but vital
- Enter polarised VCSELs
 - Carefully placed and timed
 - we have the roll angle
- We have relative orientation sensing!
 - no longer need specialised sensors

Practical considerations

- Precision of roll sensing
 - impact is unclear so far
 - precision of direction sensing has proved to be extremely generous
 - outlook is cautiously sunny
- Assessment of savings
 - power consumption
 - unit cost