# T2TRG: Thing-to-Thing Research Group

Implementers’ Workshop
October 27, 2016, Ludwigsburg (Stuttgart), Germany

Chairs: Carsten Bormann & Ari Keränen

# Note Well

- You may be recorded
- The IPR guidelines of the IETF apply:
  see **http://irtf.org/ipr** for details.

# Administrivia (I)

- Pink Sheet
- Note-Takers
- Off-site (Jabber, Hangout?)
  - **xmpp:t2trg@jabber.ietf.org?join**
- Mailing List: **t2trg@irtf.org** — subscribe at: **https://www.ietf.org/mailman/listinfo/t2trg**
- Repo: **https://github.com/t2trg/2016-10-implementers**

# Agenda (1)

**Morning**

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| 12:00 | (Chairs) | other DTLS implementations; DTLS issues: CBC, DTLS 1.3, compatibility, stapling |

12:30 Lunch

# Agenda (2)

**Afternoon**
13:45 (Matthias, all) API issues (CoAP, RD), memoy management
14:05 (Carsten, all) alternative transports, NAT traversal, offline notification
14:35 (all) Dynamic addresses, CoAP endpoints, and DTLS
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16:05 Coffee Break
16:30 (Carsten, all) Privacy-enhanced session resumption, long-term identifiers revisited
17:00 (all) emerging topics (e.g., more on DTLS)
18:00 (Chairs) Wrapup; next steps
18:30 End of meeting

19:00 Dinner

# T2TRG scope & goals

- Open research issues in turning a true "Internet of Things" into reality
  - Internet where low-resource nodes ("things", "constrained nodes") can communicate among themselves and with the wider Internet
- Focus on issues with opportunities for IETF standardization
  - Start at the IP adaptation layer
  - End at the application layer with architectures and APIs for communicating and making data and management functions, including security

# Done so far

- Chartered in December 2015. Multiple meetings before official chartering co-located with IETF meetings and with W3C Web of Things (WoT) group
- 2016: RG meetings at Nice and Lisbon co-located with W3C WoT, at San Jose co-located with IAB IoT**SI** WS, at Buenos Aires and Berlin with the IETF meetings; participated in Dublin IAB IoT**SU** WS; RIOT summit in Berlin
- Three RG deliverable documents in progress on REST and security; multiple new documents on REST interaction
- Outreach (e.g., organizations like OCF and Bluetooth SIG)

# Where are we going

- Work on RG deliverables and outreach continues
- Future meetings co-located with good research venues (2017)
- Meetings co-located with open source activity
  - RIOT summit in Berlin (July)
  - Eclipse IoT meeting (here)
- Benchmark/reference scenarios
  - Initial discussion in various drafts and slides
  - More elaborate documentation by end of 2016

# Next meetings

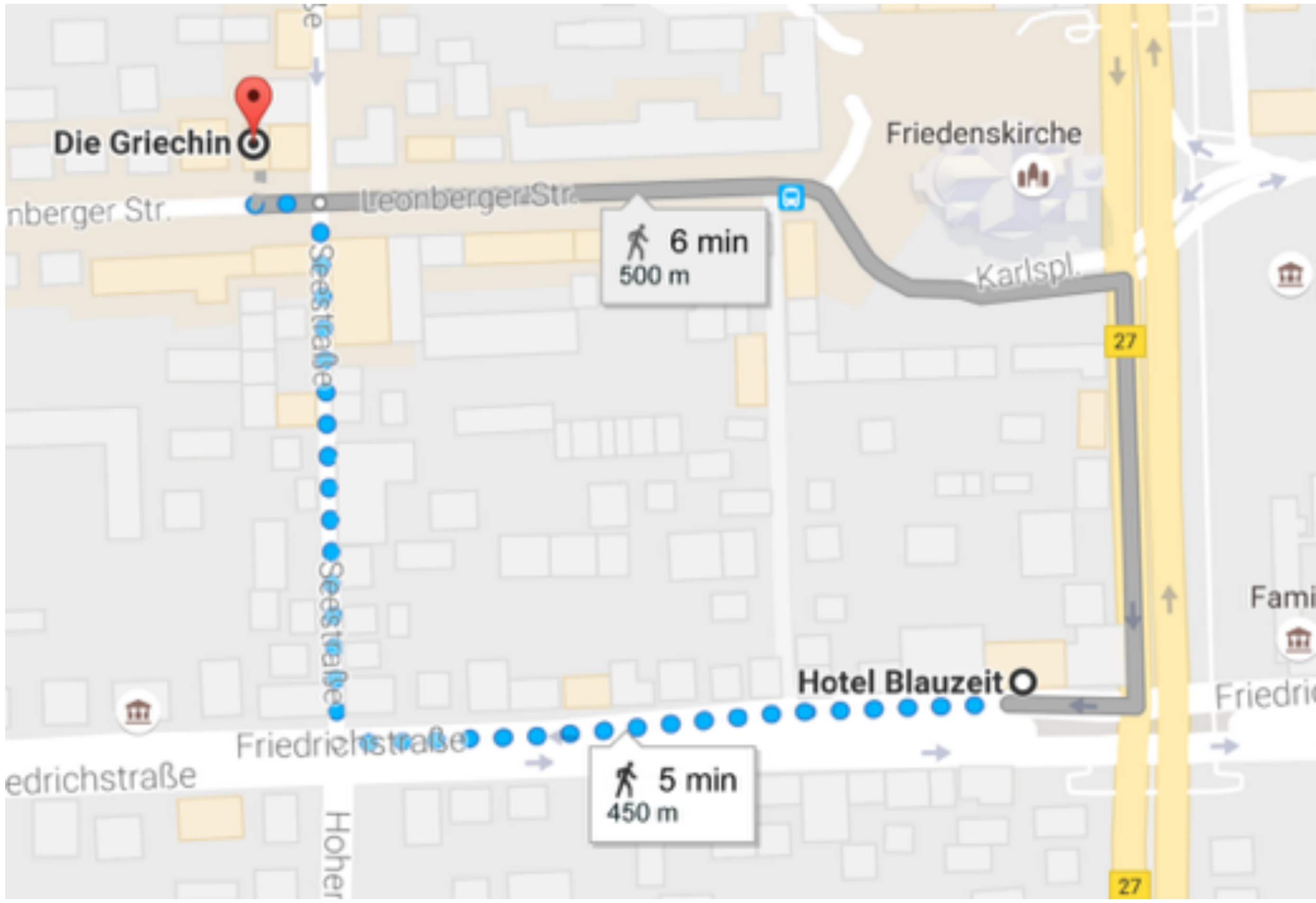
- Meet with ICNRG in Seoul before IETF97 (Sun Nov 13)
    - Issue worth discussing: data naming
- Academic: February @EWSN?
    - Maybe look at system issues (radio to application)

# Lunch

- Approx. 12:30

  Restaurant "Die Griechin”

  Leonberger Str. 23 / 1



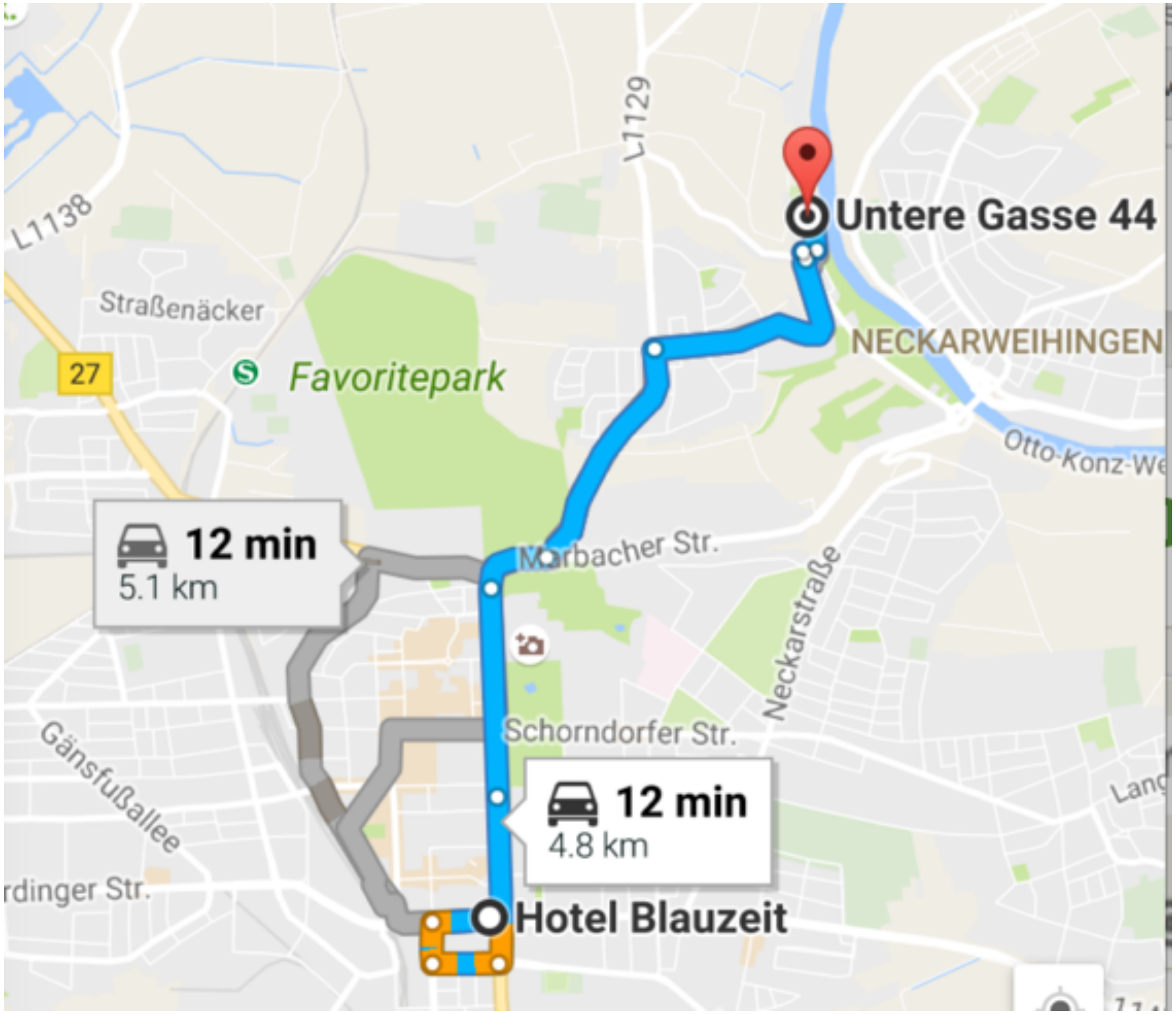

http://www.die-griechin.de/speisekarte/mittagstisch/index.html

# Dinner

- Table of 15± booked at 19:00 at

  Krone Alt-Hoheneck

- Car-pooling required



# Thank you,

- Siemens, for the room,
- Ericsson, for the refreshments,
- Eclipse, for the organization

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# CoAP over TCP, TLS, …

- http://tools.ietf.org/html/draft-ietf-core-coap-tcp-tls-05.txt
- In WG last-call (till 2016-11-01)
  - Just send your comments to core@ietf.org
- Covers TCP, TLS/TCP, Websockets (WS), WSS

# Why TCP?

- Within Backend: More efficient for large amounts of messages

- For NAT traversal: TCP NAT bindings live much longer than UDP NAT bindings (device-to-cloud scenario)

# Why Websockets?

- Browsers don’t do CoAP natively yet
- Web application front-ends can speak CoAP over Websockets to a hub or a cloud endpoint
- (Also, Websockets are sometimes last resort for firewall traversal)

# Framing

- TCP: Add length field to demarcate messages
  - After some waffling, adopted “L3” variant (as OCF)
  - Not needed for Websockets
- Leave out message-ids and message types
  - message reliability covered by TCP

# BERT

- Block-wise not needed if a large message-size is agreed
- But can cause head-of-line blocking
- BERT: Just send multiple 1024-byte blocks in one CoAP message
- SZX=7

# Signaling Messages

- Signaling Messages are about the connection, not about a request/response pair
- Standard CoAP message format, use 7.xx codes
- SM Option numbers are specific to a 7.xx code

# CSM

- Capability and Settings Messages
- MUST be exchanged at the start (not in current OCF!)
- Capabilities: Block transfer, Message size > 1152
- Can do SNI

# Ping/Pong

- A Ping elicits a Pong (echoing Token)
- Custody option in Pong:
  "I really have processed everything up to the Ping"

# Release, Abort

- Release: Orderly release
  - Hold-off option if this was for load-shedding
  - Can give Alternate-Address
- Abort:
  At least give a reason before slamming the receiver
- Can use diagnostic payload in either (please do!)

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# Intermission: LWM2M

- LWM2M is using Content-Formats 1542 and 1543
- This is a reserved space in CoAP, so the attempt to register this got stuck
- Proposed Solution:
    - IANA assigns 11542 and 11543 for the two LWM2M media types
    - To avoid trainwrecks, IANA marks 1542 and 1543 as “reserved, do not use”

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# Endpoints

- Endpoint: you || the other party that you are talking to
- Initiator (Client):
  Server learns about it when the request hits
- Responder (Server):
  Client needs to “find” it (from URI data)

# Endpoints in HTTP

- Server endpoint: Scheme/Host/Port (**Origin**)
  - Translated to Address/Port by client (**DNS**)
  - HTTPS: Client verifies DNS name of Host (**PKI**)
- Client endpoint: anonymous
  - Can use Client Address/Port (usually considered ephemeral)
  - Client certs: rare
  - Put Client identity into **Cookie** (muddled up with application state)

# What’s different in CoAP

- **DNS** deemphasized
- Certs (and thus **PKI**) deemphasized
  - PKI Certs need CRLs/OCSP, secure absolute time, …
- We don’t have **cookies**
- **Servients**: Servers often have client component — how to link their identities?

# Endpoints in CoAP/UDP

- Client uses **URI data** to look up server transport address
    - lookup mechanism intentionally not defined in RFC 7252
- Server uses **request transport address** to reply and send notifications

# CoAP/UDP: Issues

- Endpoint transport addresses might not be stable
  - IP addresses change due to renumbering
  - Transport addresses change due to NAT timeouts
- Transport address change loses endpoint identity

# CoAP/UDP: Issues

- Server address change:
  - New requests:
    Lookup mechanism likely to use cache ➔ stale info
  - Observe, other long-running requests:
    Client cannot relate Notification to the right server
- Client address change:
  - Observe, other long-running requests:
    Server cannot send Notification to the right client

# Endpoints in CoAP/DTLS

- Client uses **URI data** to look up server transport address
- Client states (**SNI**) and verifies server identity
  (and server possibly verifies client identity)
- Endpoint is the peer in the resulting **connection**
  - Ephemeral: endpoint dies with connection
  - (but long-term endpoint “identity” doesn’t)

# SNI: Server Name Indication

- SNI: TLS option for client hello
  - Tells Server what cert to send in the server hello
- In HTTPS, derived from DNS name (hostname)
  - Can’t do that for IP address
- “Common” cop-out: Use RD EP id for SNI

# “Identity”

- Most misunderstood word in security
- Identity = set of claims
    - But that’s not how we use the term intuitively
- Need another word for the “real-world identity” of a Thing
    - But what is that?  Owner change, role change, repairs (replace board/chip)…
- Where authorization is entirely identity-based: need “revocation”

# Endpoint claims in HTTPS

- server: DNS name
  (tied into Authority and thus Origin)

  - Cert can actually have other claims,
    but those are rarely visible to application

- client: (could have cert, but usually:)
  established in-band, then reified into cookies

# Endpoint claims in COAPS

- PSK mode: mutual verification
  - needs out of band channel; cf. DCAF
  - source, scope specified by those OOB mechanisms
- RPK mode: implicit server identity claim
  - OOB channel can be used (e.g., with directed identity)
- Cert mode: less well-defined (could use HTTPS model)

# Implicit vs. Explicit Claims

- PSK: Implicit claim of existing security association
- RPK: Implicit claim of server possession of private key
  - Both can be augmented by OOB information
- Cert: Explicit claim of SNI possession (time-bounded)
- With CWT, have more fine-grained, explicit claims:
  - Issuer, Audience, Scope, …

# Identity confusion in APIs

- Very little of this makes it into APIs
- E.g., IoTivity uses the transport address as endpoint identity — even with DTLS
    - Application may send data via new, unrelated DTLS connection that happens to have the same transport address
- Issue: How to represent endpoints in APIs?

# CoAP/DTLS: Issues

- DTLS connection tied to transport address pair
  - dies when either pair changes
- Current request/response matching includes “epoch”
  - does not even extend Observe across session resumption

# Resumption

- Could extend matching (and thus endpoints) across resumption
- Issues:
  - garbage collection (when to discard session state?)
  - who is responsible for resumption?
  - (what exactly is the security semantics?)

# Drafts to read

- draft-hummen-dtls-extended-session-resumption-01.txt (2013): **prepare** for resumption
- draft-barrett-mobile-dtls-01.txt (2009): send connection identifier to enable resumption later

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