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Cybersecurity challenges in the IoT era

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Using IoT platform security with mF2C to develop scalable secure edge-to-cloud applications

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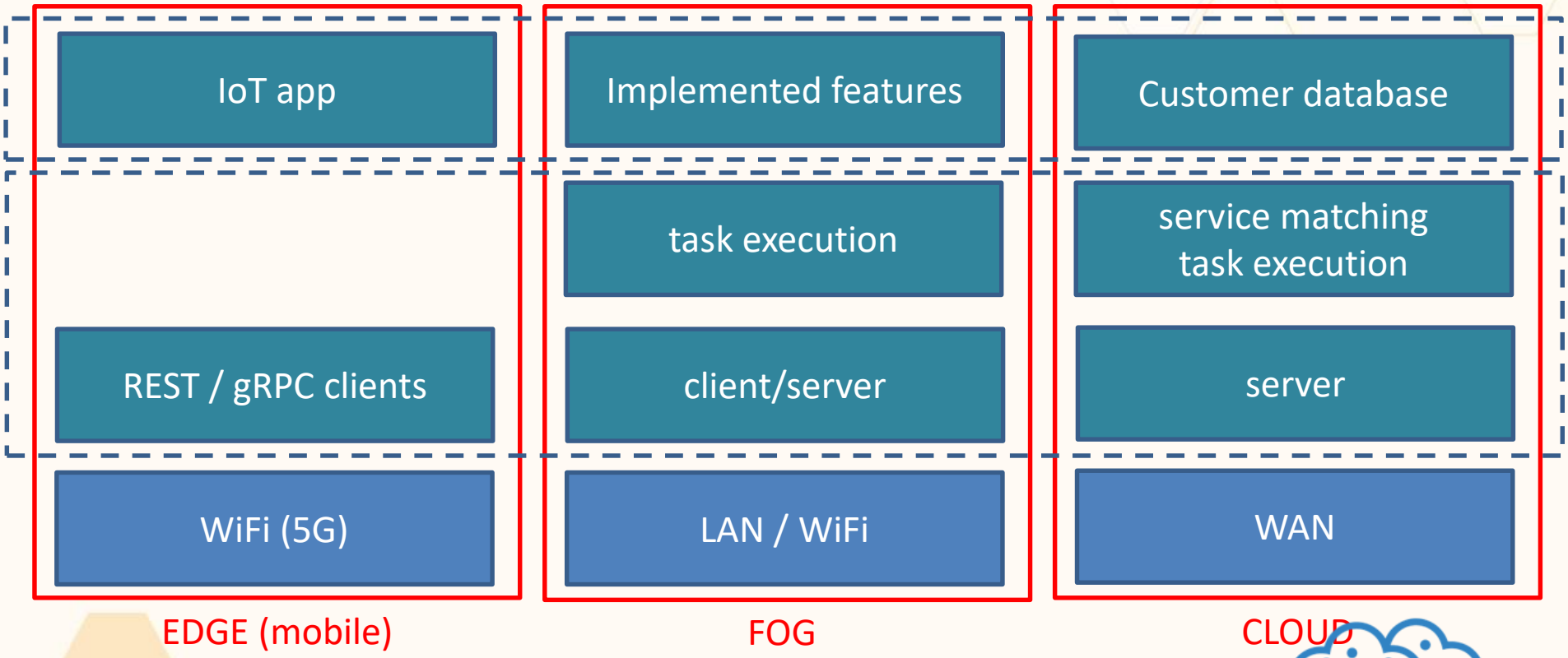
IoT Challenges

- Trust/Reputation of IoT
  - "Why should I trust this?"
- Legacy of IoT
  - Loads of insecure stuff already out there
- Barriers to building new applications
  - Have you ever programmed a microcontroller?
  - Limited devices (comp/mem/storage.)
- Keeping it secure
  - Potentially huge "attack surface"
  - Human factors, human bias

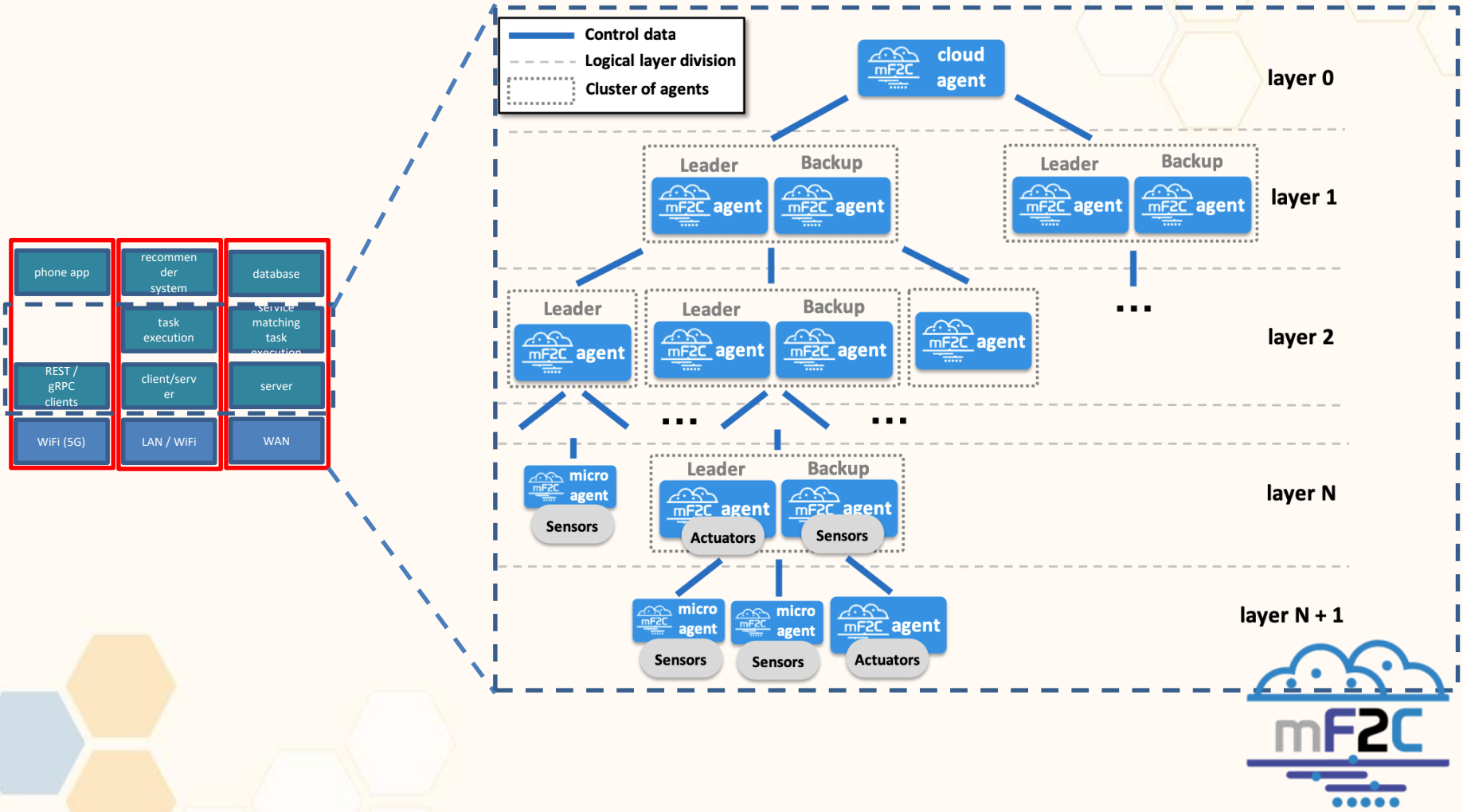
Platform Premises

- mF2C focuses on edge->fog->cloud applications
  - Tasks/data pushed to higher level if needed
- Build a *platform* for building applications
- Three use case applications:
  - Building sensors for emergencies (e.g. earthquakes)
  - Smart boats for boat sensor/location/harbour
  - Airport hub for traveller assistance

Generic Application
OSI (near enough) stack view



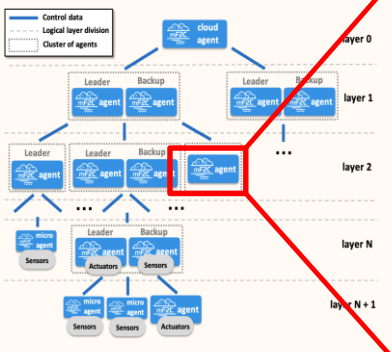
Platform Architecture



Security Features

- Usually, device == 1 agent
  - Or microagent for smaller devices
- Device id tracks device lifetime
- Certification Authority in the cloud
  - Certificates to capable (fog) devices
  - Private key generated by (capable) device
  - Gateway gives access to cloud service
  - No Internet access for unauthenticated devices
- Edgier devices have private (typ. a serial bus) link to foggier devices

Zooming in further



mF2C Agent

Platform Manager

Service Orchestration

- Lifecycle management
- SLA management

Service Management

- Categorization
- QoS Providing
- QoS Enforcement

Distributed Exec. Runtime

- Task Management
- Task Scheduling
- COMPSs
- Policies

Telemetry Monitoring

- Landscaper
- Recomender
- Analytics Engine

Agent Controller

Resource Management

- Discovery
- Policies
- Identification
- Categorization - Monitoring

User Management

- Profiling
- Sharing model
- Assessment

- Event Manager
- GUI

APIs: Docker | Kubernetes | Swarm | CIMI

Data Management: Dataclay

Security: Reverse Proxy | CAU Client | AC library

Addressing the challenges - Trust

- PKI for all participants
  - Distinct PKI roots for infrastructure and agents
  - Optionally distinct PKI for application
- CI/CD through Docker containers
- Trust model for security
- Application data
  - PUBLIC for unprotected
  - PROTECTED for integrity protected
  - PRIVATE for integrity and confidentiality

Addressing Challenges – Legacy

- mF2C builds entirely new applications, so no legacy?
- Some users bring own devices
- => botnet detection

- Early work on botnet detection
  - Distinguish attack from (say) emergency
  - Remote control of router/firewalls

Addressing Challenges - Barriers

- Build application on platform
  - … however, mF2C is a research project

:-)

- Open source
- High TRL on some components
- Lots of clever people adding lots of clever features
- Some code written by professional programmers and RSEs

:-(

- Platform has more features than a given app might need?
- Low TRL on some components
- Some code written by students rather than RSEs?

Addressing Challenges – Future

- mF2C updates through its CD framework
- Phone app (airport use case) through app store
- Edge hardware/firmware not addressed in project
  - (e.g. Azure Sphere..)
- Those pesky humans...
  - Make it easier to do the Right Thing
  - Need transparency for GDPR, too

Thanks!

- https://mf2c-project.eu/
- https://github.com/mF2C/

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