Upcoming EC Systems Research Perspectives

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EU Computing Systems Strategy Drivers

Heterogeneous Networked Service and Computing Environments

Architectures, Future Internet, Cloud, CIP, Virtualization, Metrics, Enabling Technologies...

e/m-Infrastructures

e/m-Commerce, CI's ...: Trust Provision and Assurance, Usability...

Data Policy, Governance and Socio-economic Ecosystems

Data Trust Policies, Governance & Management...

The EC 2020 Framework's Vision

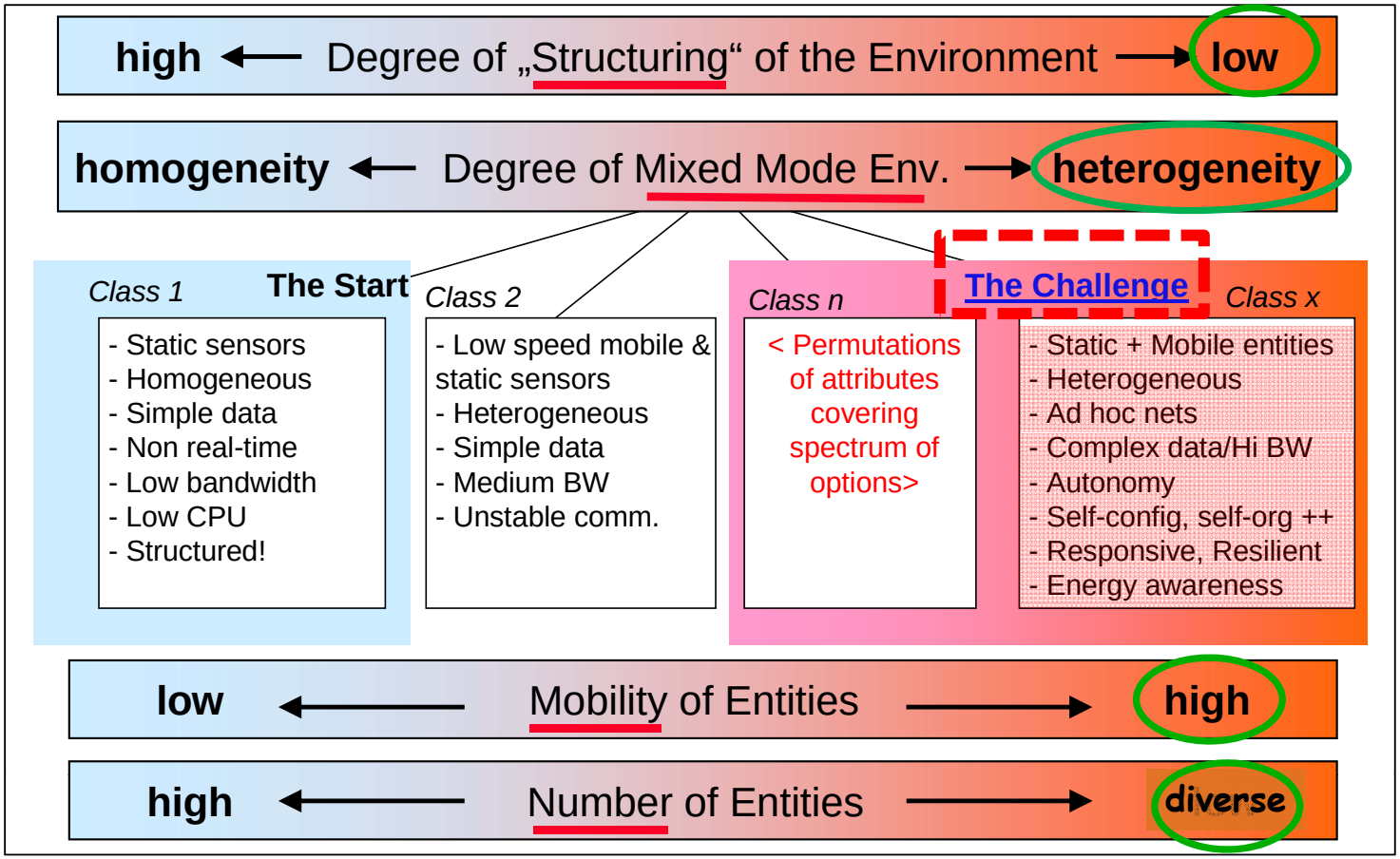
- What I will not be doing in this talk
  - Not detailing application areas
  - Not detailing technology themes (concurrent/multi-core computing, ES, Virtualization) … on a standalone basis!
  - Not detailing FP7 projects beyond a landscape picture

- What I will do
  - Describe technology thinking behind upcoming EC Frameworks

1. Internet of Things (e/m-Services, Digital Media, Healthcare, Education…)
2. Cloud → Data e/m-Infrastructures

+ CI's, Smart Grid, Financial, Data Farms…

IoT: Open, Unstructured, Diverse, Mobile Environments

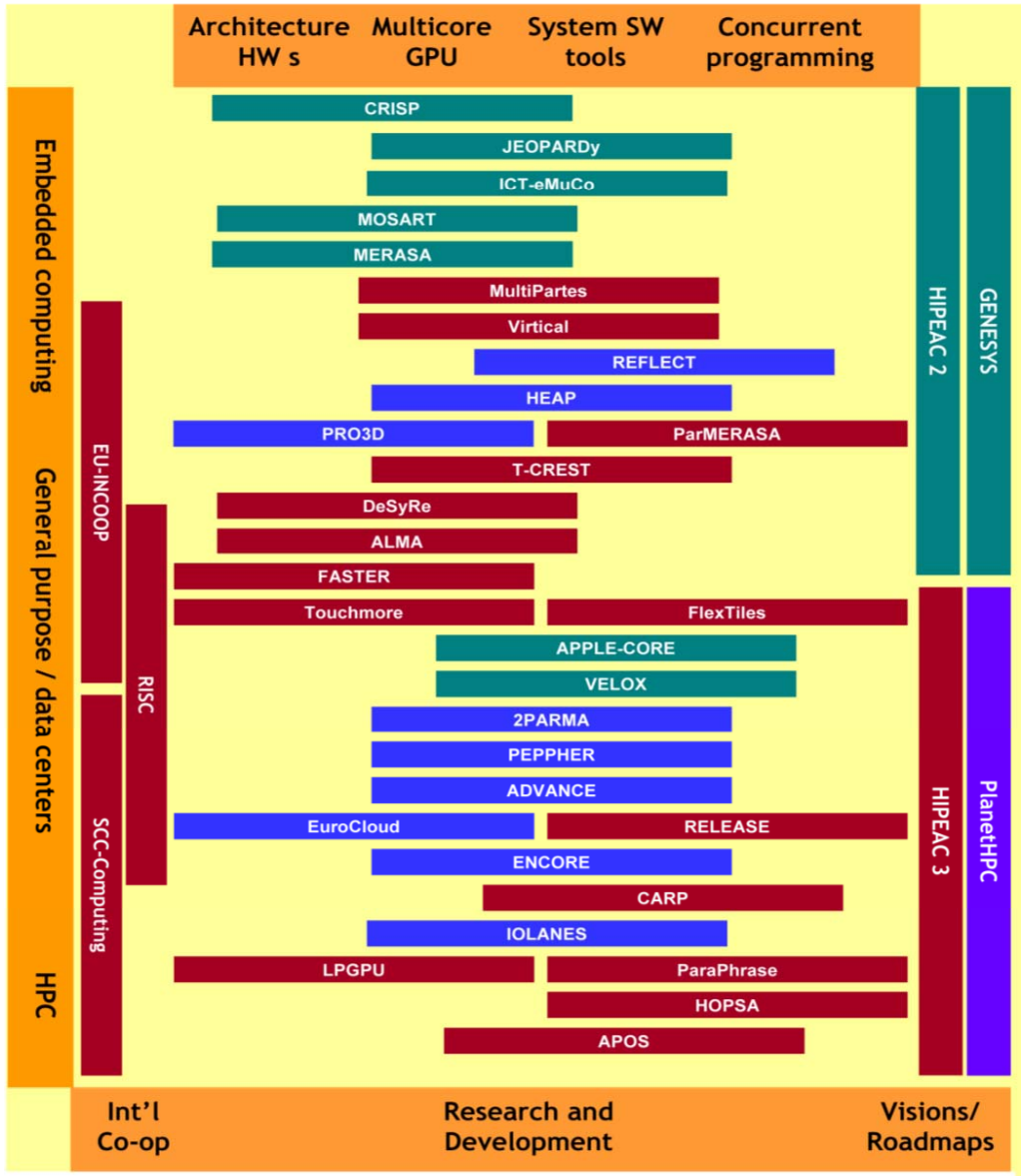


The IoT Spectrum

- Focus Themes: WSN/WSAN, Mobile Computing
  - ES Sensory Spectrum (Features, performance, power mgmt…)
  - Functional Architectures (Scalable, MM Heterogeneity, Hybrid…)
  - Connectivity Problems (Network and Middleware Stacks)
  - Mixed criticality integrations (ES: auto/aerospace/CI…)
  - Composition/SoS (SmartGrid, CI e-infrastructures…)

  ✓ Use cases, applications and testbeds galore!
  ✓ Enabling technologies (HW/SW Design, Analysis, Tools, V&V…)

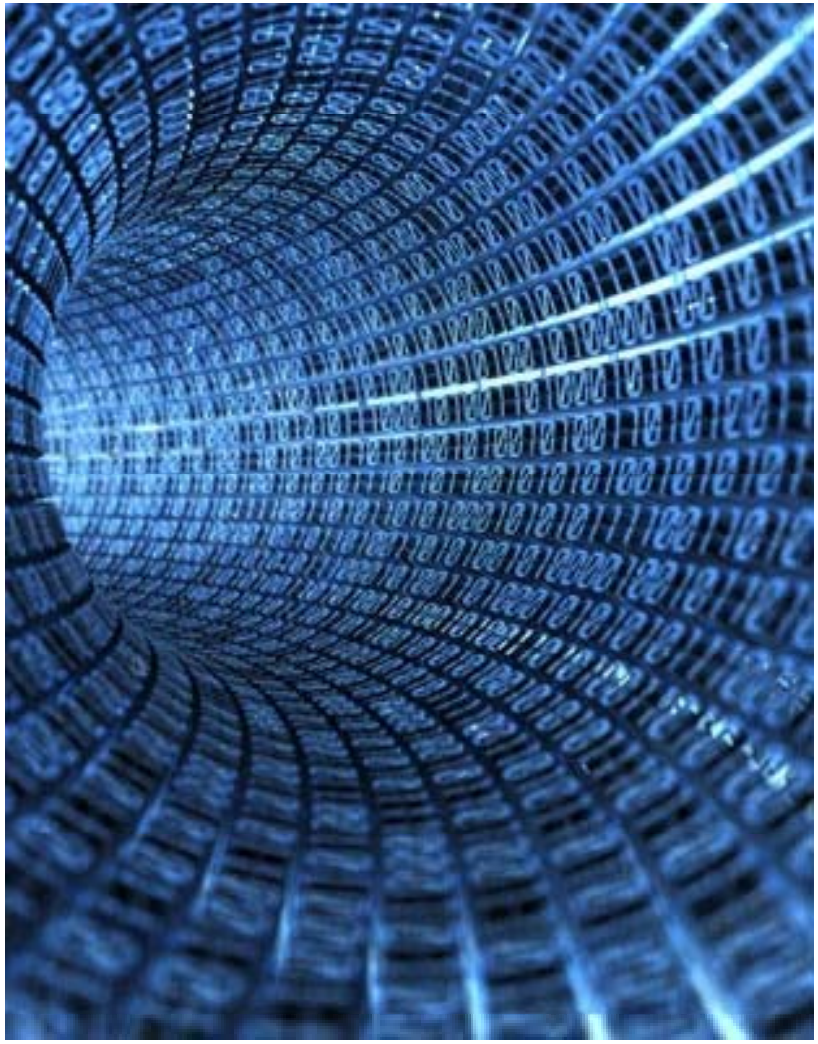
Computing Systems Profile



- ARTEMIS
- NESSI
- HiPEAC
- …

Data → Cloud → (Trustworthy) Data eInfrastructures

The Data Chain Abstraction in Scale-less Systems

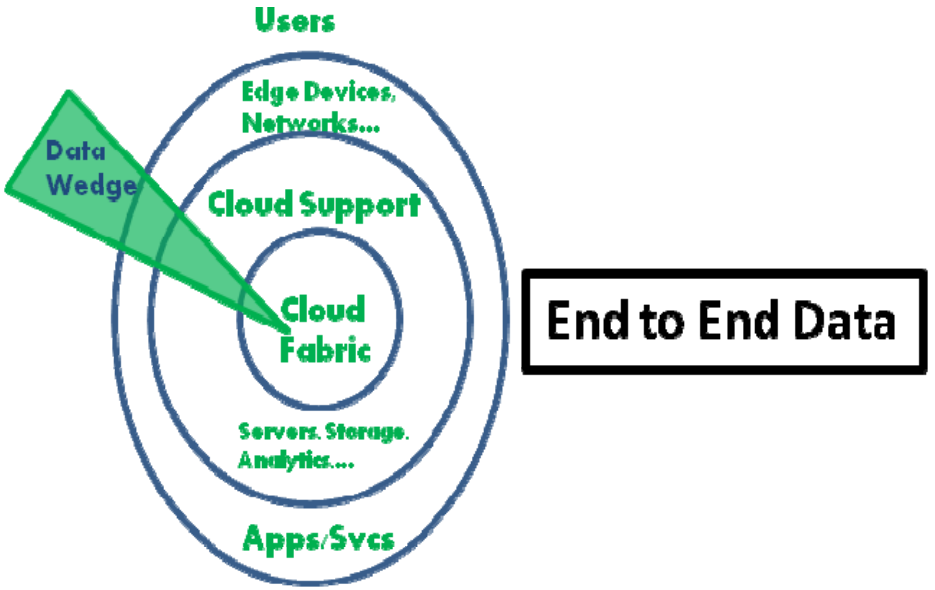


- Data Acquisition
- Data Dissemination
- Data Storage
- Data Management/Usage

❑ Large scale systems (architectures, infrastructures) are evolving to incorporate unstructured & open operational elements (including users!): The focal issue is to identify the underlying "structures" as core building blocks and interfaces to develop coherent solutions that are domain & technologically invariant.

Data Acquisition

- WSN/Mobile: Edge Devices, Edge Networks … & Users
- Interface to users, networks and fabric

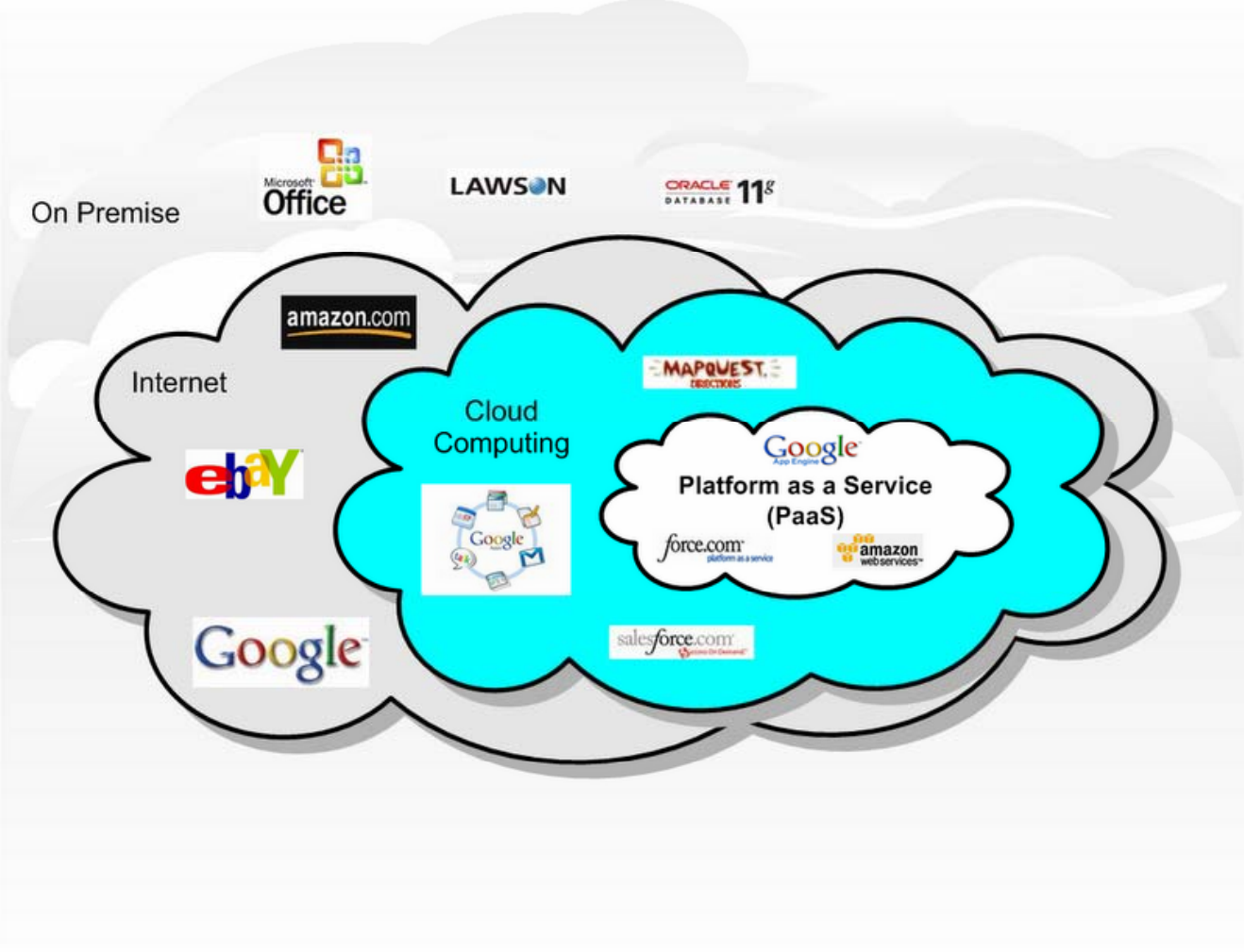


Data Acquisition + Dissemination

- Sensor → Device interfaces
  - Sensors
  - WSN data delivery – energy, reliability, timeliness (QoI basis), pre/post processing models, net partitioning, … WSAN!
- Device → Network interfaces
  - Mobile transaction architectures
- Network Stacks
- Network → SW/OS/Middleware/Server Architectures
- Data Handling

➢ Enabling technologies: mobile protocols, virtualization layers, concurrent programming, performance drivers - multi-core…

Data Access, Storage & Management



Big Data Issues: Performance, Accountability, Trust…

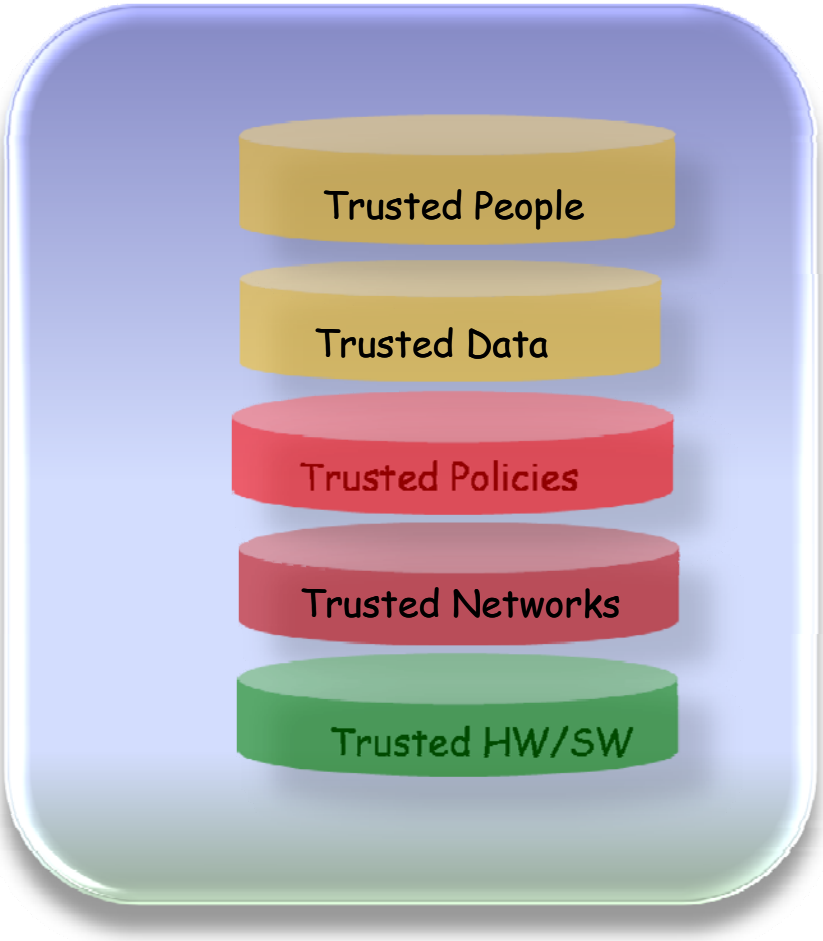
- Performance
  - Enabling technologies
  - Architectures
  - Tools – design, analysis, V&V, …and Testbeds!!!

- Data Acquisition
- Data Dissemination
- Data Storage
- Data Management

- Accountability?
  - Appropriate use
  - Access control
  - Traceability
  - Governance
  - Liability
  - Compliance
  - …

- At what level & by what "trusted" authority ?
- For services?
- For applications?
- Inter-resource?
- Data ownership – digital rights?
  - Browsing data?
  - Financial data?
  - Legal?

Trust Stacks & Technologies



- Trust is an end-to-end attribute …and on a global data chain (esp w. mobile/cloud)!

  -Trust is NOT a piecemeal property - attacks target the entire trust chain (the blocks, the interfaces, the technology changes and users!!!) for the "weakest link" vulnerabilities on the overall attack surface.

- Trust driven global collaboration?
  - Contextualize technologies under a framework (trust): eg. Virtualization
  - …under Domains e.g. CI: Telco, Servers, Financial…
    - Sensors, Networks, protocols, policies
    - Enabling technologies…

Trust Profile

Collaboration Perspectives

- While one can come up with many innovative solutions (sensors, monitoring, routing, replication, SW architectures, "*your favorite approach here*" etc) , the EC collaboration potential comes from technology level linkages

  - Globally conformal data ownership and data accountability – individual and institutional?
  - Data monitoring/storage/access: Regulation? Governance?
  - Reliable, secure information delivery techniques
  - SW/Middleware stack, access control, storage technologies
  - CIP - international repository of threat patterns – monitoring, responsiveness, governance, liability
  - …

Cooperation: Technology, Technology, Technology…

- Target common interests at the "technology" level than "local" applications
  - Technology is easily customizable to match local interests!
  - Shape local interests as "scenarios" with additive "local depth"
  - If scenarios result in unique technology aspects – that's a hit!
    → Use cases (scale, heterogeneity, usability), Testbeds etc.

- This is also the core external-EC justification that actually carries value if frameworks and trans-national inter-connected linking issues (e-commerce, data farms, CIP…& attacks, liability, enforcement) are utilized as key mental models to base technology driven co-operations

ICT 2013: Nov 2013

- https://ec.europa.eu/digital-agenda/en/news/ict-2013-create-connect-grow