# Living The Future

in the

Communications Futures Testbed

A Proposal to MIT, the CFP sponsors & everybody interested

# Purpose of This Proposal

Propose the establishment of a large scale test bed at MIT to experiment with existing and novel application concepts based on existing, upcoming and not yet conceived networking concepts and technologies

For that: Clarify the

- WHY (**Drivers**)

- WHAT (**Content**)

- HOW (**Operation & Organization**)

with these slides

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# Goal of This Presentation

- Test the fields
  - Get initial interest of CFP sponsors for this
  - Get feedback on details


If interested

- Develop proposal further with more concrete operational content
  - Contacts with operational folks from MIT (e.g., meeting in spring)
  - Contacts with interested sponsors separately or jointly
    - Also: contact other prospective partners for this undertaking


**Next Step: Elaborated proposal at June meeting to present to MIT and sponsor community to get dedicated commitment**

# WHY?

Drivers

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# Drivers for Undertaking

- Technical
  - Emergence of
    - new application & networking environments
    - new devices
    - larger number of possible access technologies
    in the wireless, mobile and fixed space

- Economical
  - Dynamics in business models accelerating (clock speed)
  - Cross-industry entrants emerging (Google, Yahoo, Apple, …)
  - Clashes of business models with different "stickyness" approaches (e.g., Yahoo vs. mobile operator), less vertically integrated business models

- Regulatory
  - New regulatory approaches (e.g., unlicensed spectrum, spectrum trading)

- Community
  - The power of communities adds accelerating innovation effect
    - Viral developments on social, economic and technical level

- Research
  - Upcoming NSF research initiative on next generation Internet architectures (FIND) -> target technical drivers
  - Consortia like CFP operate in this space -> target economical/regulatory drivers at large

**-> Desired to have experimental environment to evolve application and networking concepts within such changing landscape**

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# Proposal

- Provide fertile ground for experimentation of novel concepts through creating a state-of-the-art test bed to implement and validate upcoming application and networking concepts as well as validating upcoming technologies

- Provide platform for sponsor and academia activities in this space and possibly create direct partner relations in relevant areas

- Facilitate end-user community participation to stimulate innovation and enable end-user creation of services and networks

- Enable future application and networking research by eventually embedding CFT into larger NSF and international research activities
    - e.g., NSF FIND activity or CFP

**-> Leverage CFP sponsor community to establish a large-scale test bed**

# Relation to CFP

- Sponsor community of CFP is leveraged to build initial interest and get commitment necessary for this undertaking

- Test bed will be used to field trial dedicated technology developments of CFP, e.g., PBB, voice mesh, VidTorrent
  - Commitment of resources for such field trial needs to be discussed for each item

- CFP will assess future work items with respect to their integration into the test bed

- CFP addresses business and regulatory issues likely to be related to CFT efforts

- Test bed provisioning likely to happen outside the current CFP sponsor agreement
  - Expected burden likely to exceed financial framework of CFP

**-> CFP is seed for CFT and possibly main driver, but partners outside CFP are needed eventually to make CFT work**

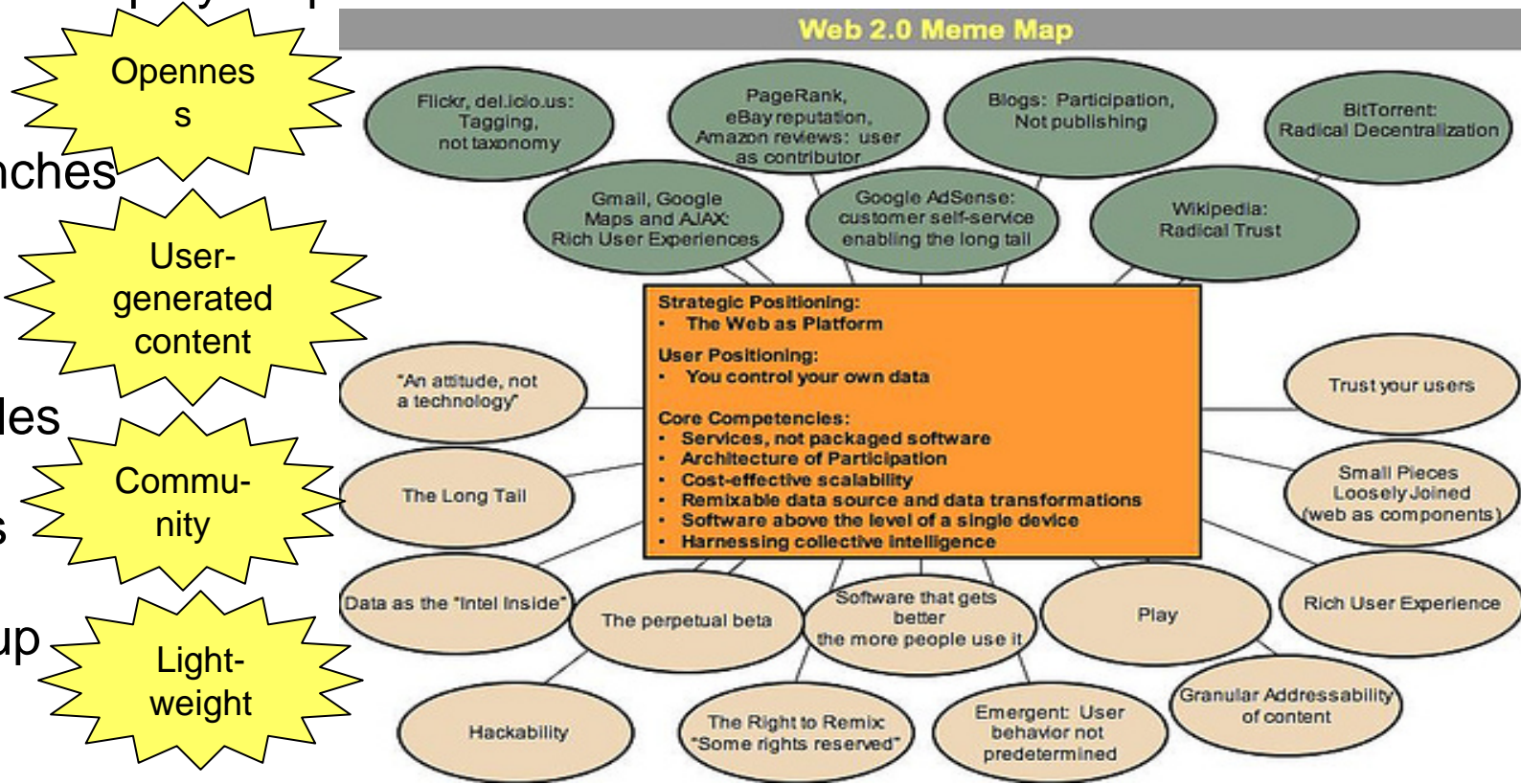© MIT, NOKIA    Presentation_Name.PPT / 23-Jan-06 / DOT

# WHAT?

## Content

# Reasoning about the Content Scope
## Lately: A Lot of Hype Around Web2.0

- 2nd Web2.0 conference. Organized by tech trend spotters O'Reilly (eTech, OSCon)
  - Sold out this year!

- All major Internet players present

- Lots of new company & product launches

- An attitude, not a technology!
  - Fast cycles
  - New business models
  - Bottom-up

*Openness*

*User-generated content*

*Commu-nity*

*Light-weight*

**Web 2.0 Meme Map**

Flickr, del.icio.us: Tagging, not taxonomy

PageRank, eBay reputation, Amazon reviews: user as contributor

Blogs: Participation, Not publishing

BitTorrent: Radical Decentralization

Gmail, Google Maps and AJAX: Rich User Experiences

Google AdSense: customer self-service enabling the long tail

Wikipedia: Radical Trust

**Strategic Positioning:**
- The Web as Platform

**User Positioning:**
- You control your own data

**Core Competencies:**
- Services, not packaged software
- Architecture of Participation
- Cost-effective scalability
- Remixable data source and data transformations
- Software above the level of a single device
- Harnessing collective intelligence

"An attitude, not a technology"

The Long Tail

Trust your users

Small Pieces Loosely Joined (web as components)

Data as the "Intel Inside"

The perpetual beta

Software that gets better the more people use it

Play

Rich User Experience

Hackability

The Right to Remix "Some rights reserved"

Emergent: User behavior not predetermined

Granular Addressability of content

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# Reasoning about the Content Scope
## Web 1.0/2.0 Services & Functionality comparison

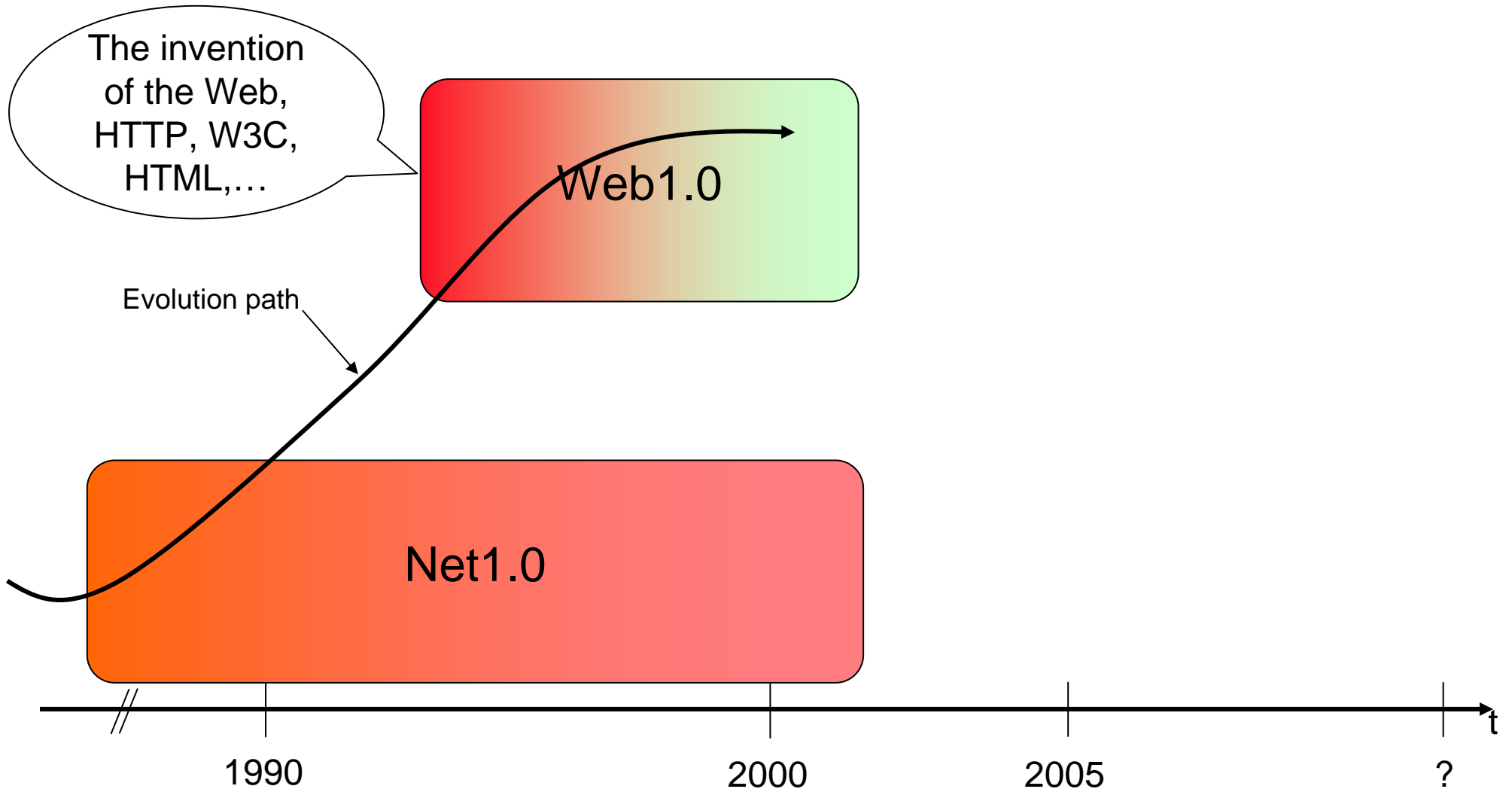| Web 1.0 | Web 2.0 |
|---|---|
| Ofoto | Flickr |
| Bookmarks in browser | Social bookmarking (Delicious) |
| Britannica Online | Wikipedia |
| Personal websites | Blogging |
| M$ Outlook | Zimbra |
| Browsing to websites | Subscribing to and receiving RSS feeds (Podcasting) |
| Publishing | Participation |
| Content created by service | Content created by the users |
| Read-only : All Rights Reserved | Add / Modify / Delete : Some Rights Reserved |
| Directories (taxonomy) | Tagging ("folksonomy"). Also TrackBacks. |
| One service | Mashups (housingmaps.com) |
| Some API's | Open API's |
| The service is static | The service improves the more it is used, data added |

Based on http://www.oreillynet.com/pub/a/oreilly/tim/news/2005/09/30/what-is-web-20.html

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# The Evolution of the Internet as We Know Today
## Conceiving the Basic Net

Early Internet work, TCP/IP, early RT apps,…

Evolution path

Net1.0

1990          2000          2005          ?

t
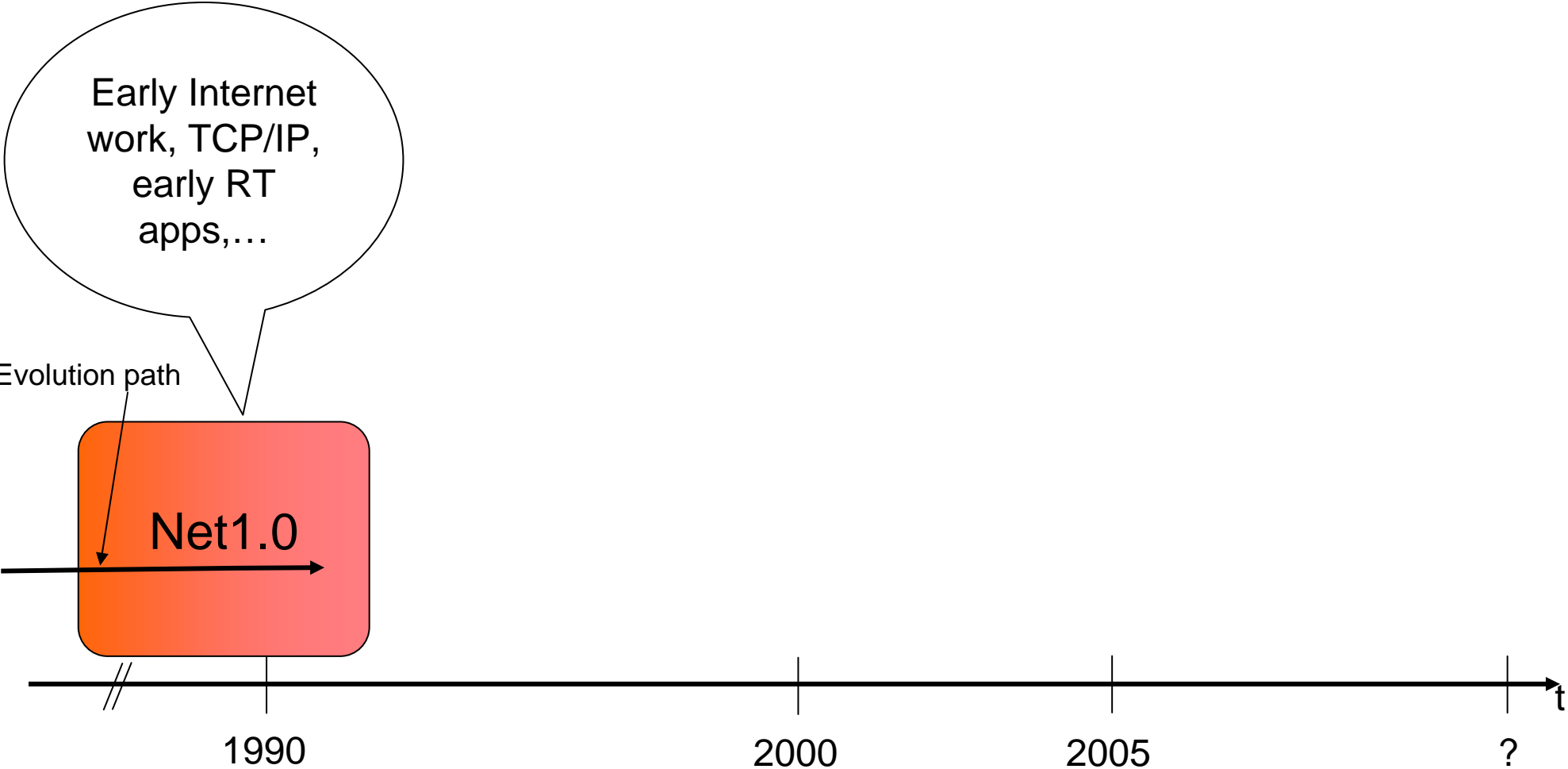
# The Evolution of the Internet as We Know Today
## The Web as the Evolution on App Level

The invention of the Web, HTTP, W3C, HTML,…

Web1.0

Evolution path

Net1.0

1990          2000          2005          ?

t

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# The Web Evolved
## Conceiving Web2.0



Blogging, Wikipedia, Flickr, end-user content,…

Web1.0

Web2.0

Evolution path

Net1.0

1990

2000

2005

?

t

MIT

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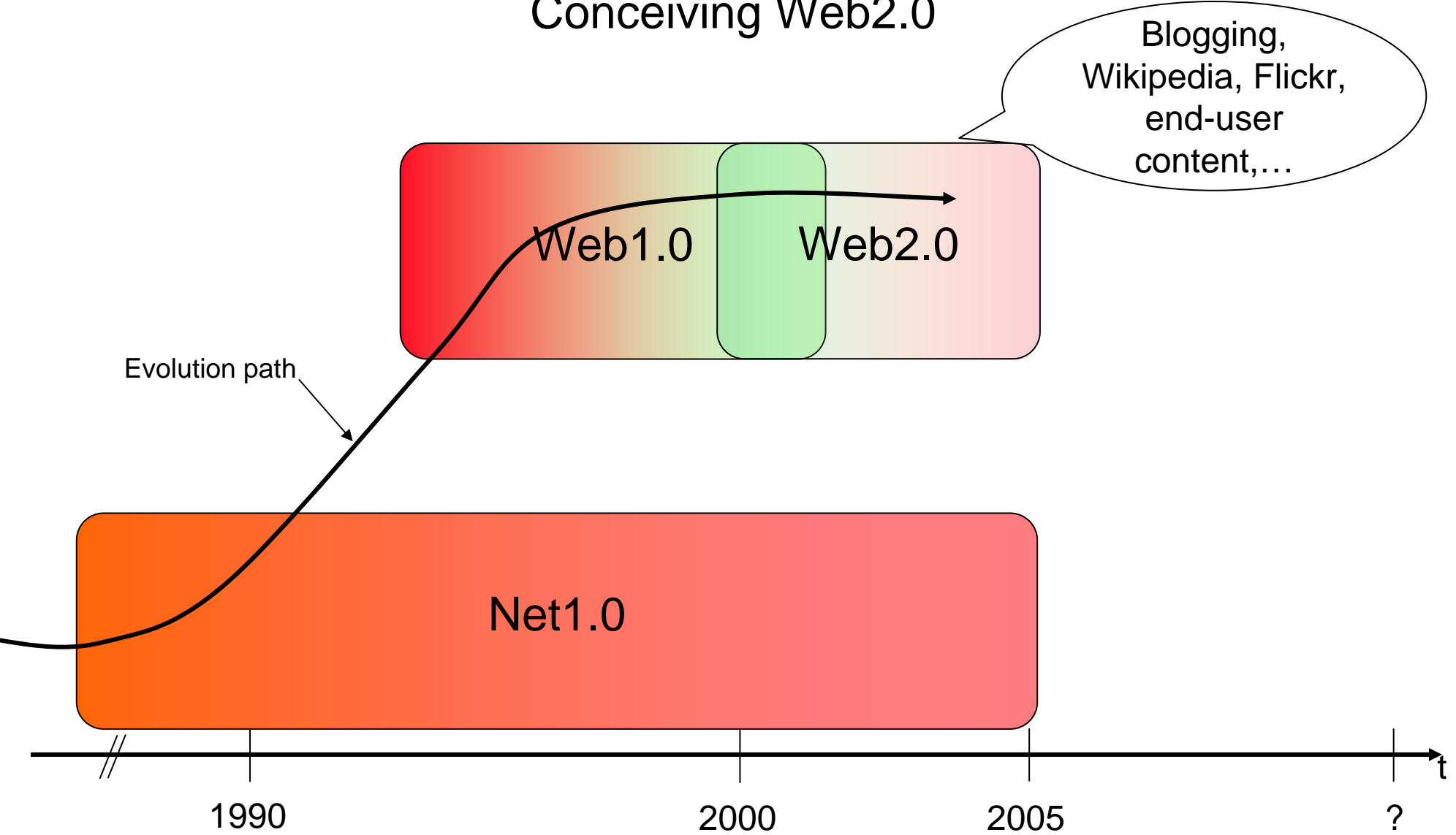
# Hypothesis: Evolving the Net as Next Step
## Conceiving Net2.0



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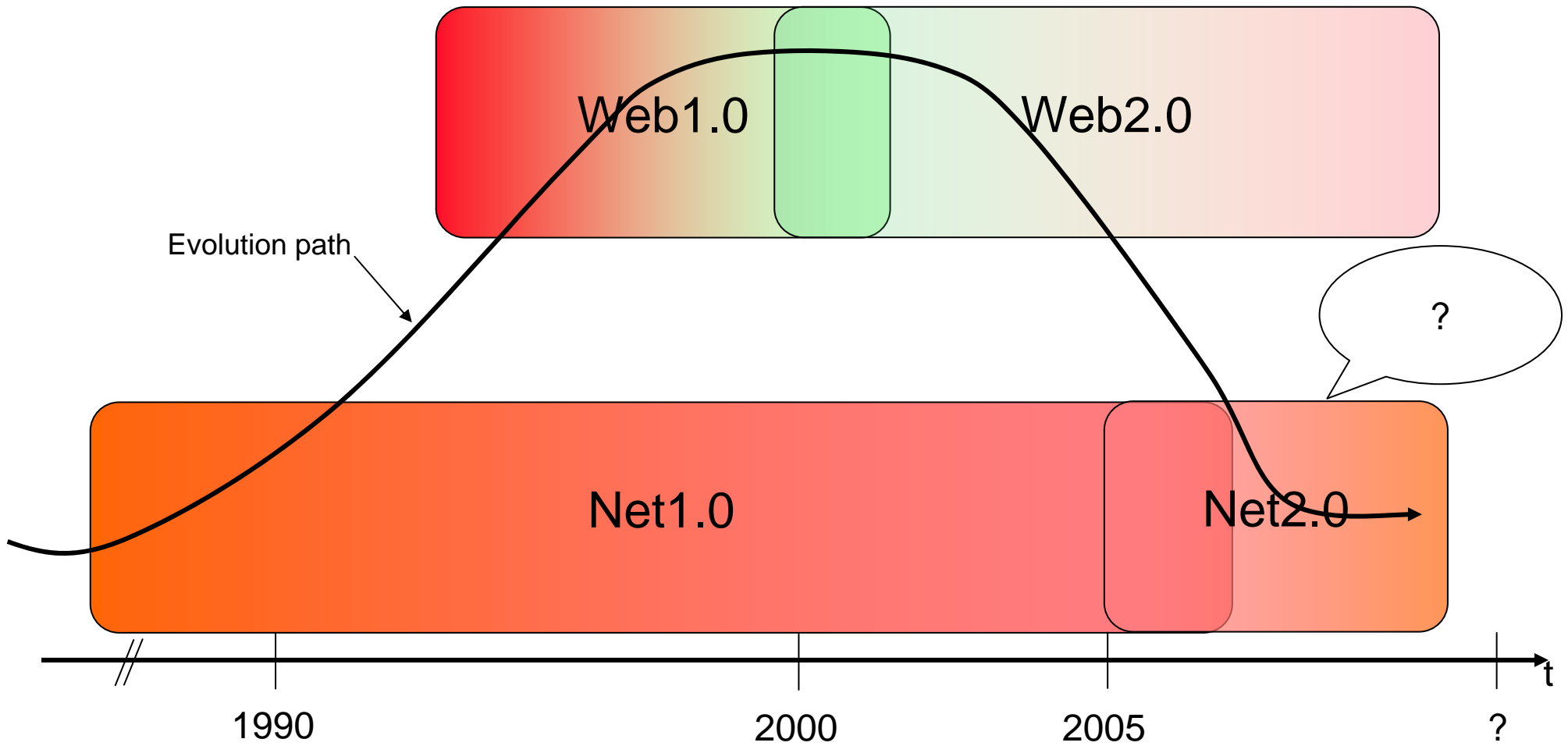
# Driving the Path of Evolution Further
## Evolving the Internet Towards its Next Version



Web1.0

Web2.0

?

Evolution path

Net1.0

Net2.0

Next Generation Internet?

1990    2000    2005    ?

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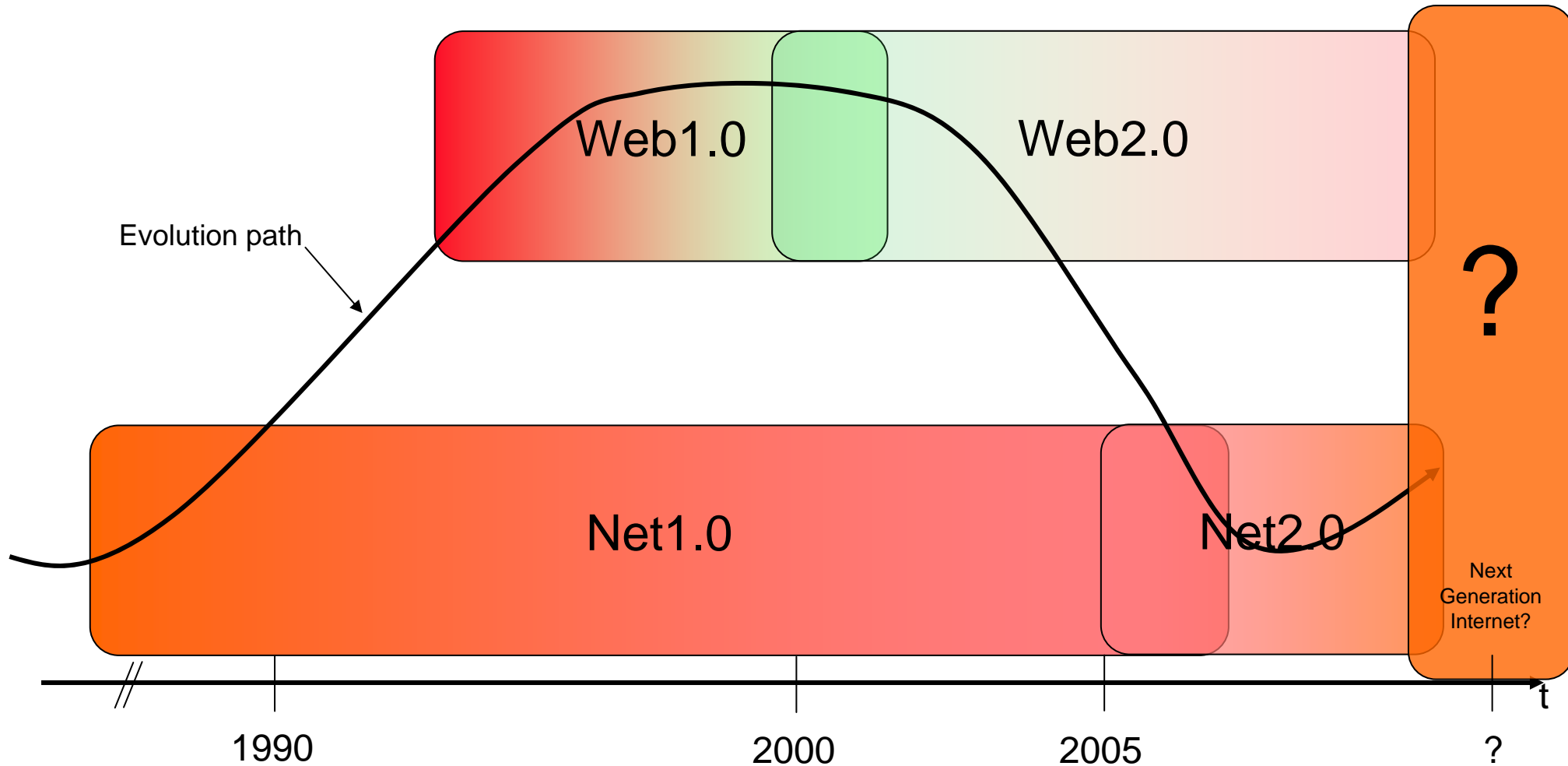
# Reasoning about the Content Scope
## Net2.0

- Adopt Web2.0 on net level
  - Openness
  - Community
  - End-user driven (edge-based)
  - Lightweight and adaptive


- Lots of the ingredients are there
  - Some need more research


- Set out agenda for evolving the Internet
  - Ties into ongoing NSF FIND activities (see later)
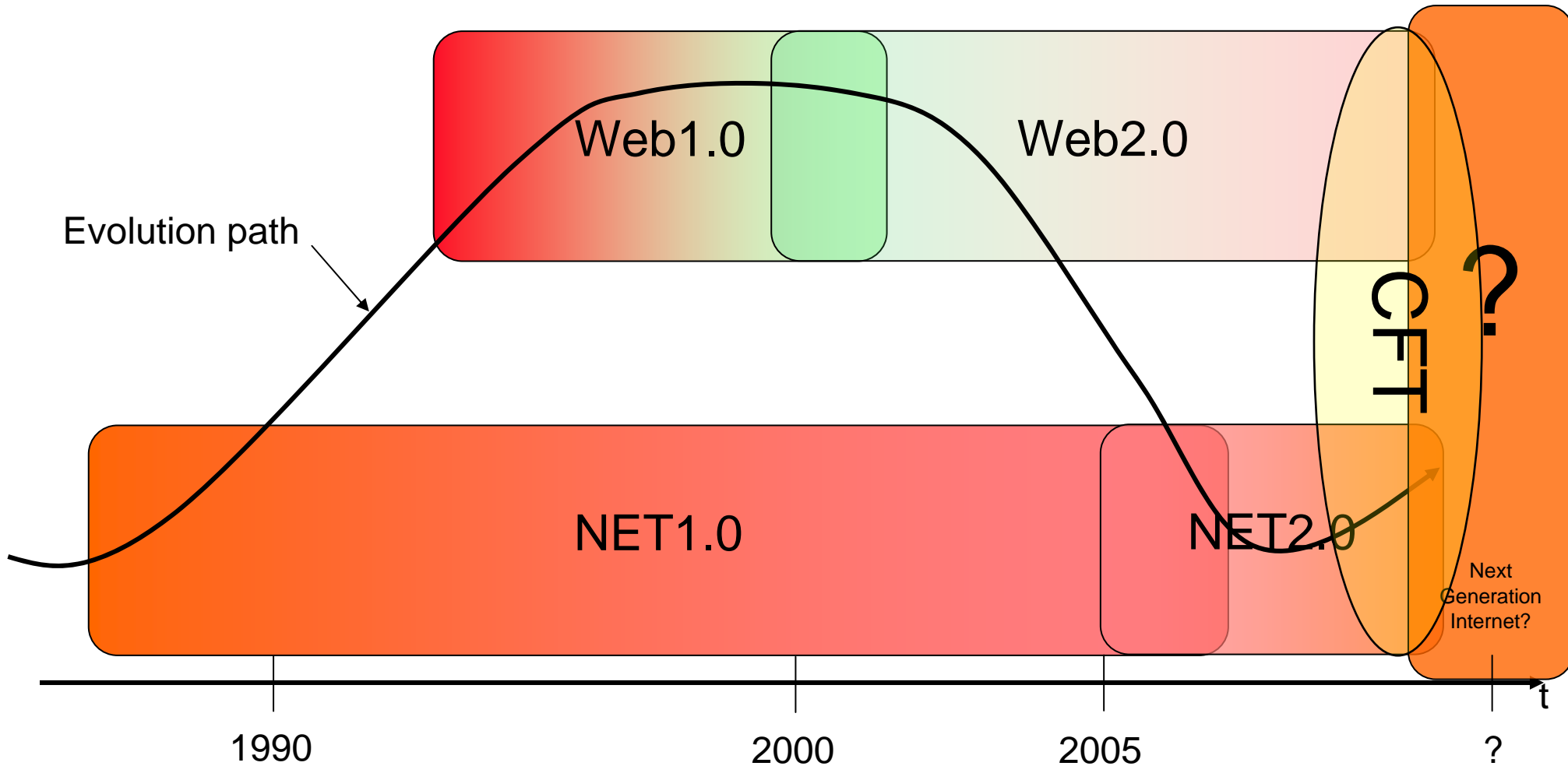
# Reasoning about the Content Scope
## Net 1.0/2.0 (Envisioned) Functionality Comparison

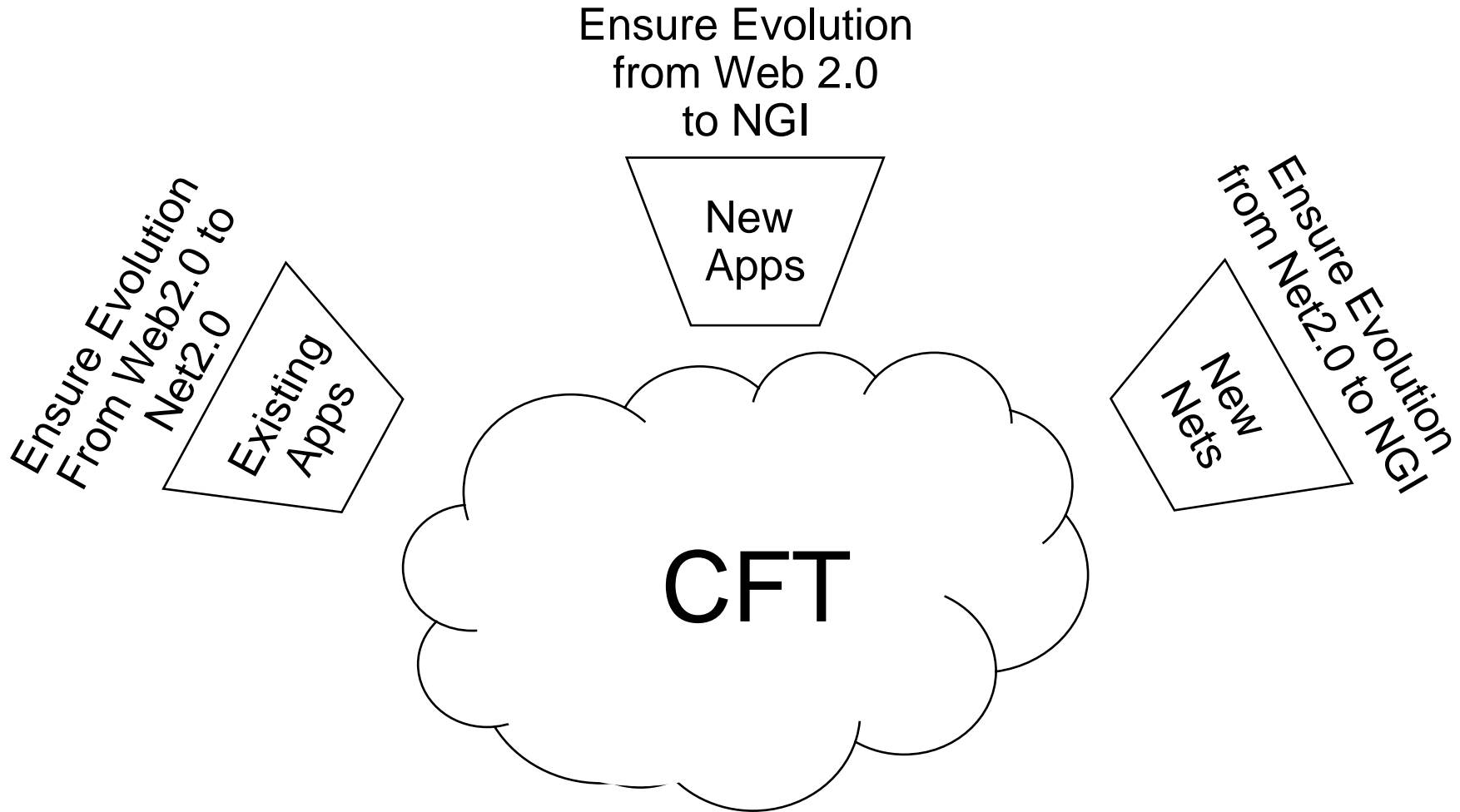| Net 1.0 | Net 2.0 |
|---|---|
| Mobile IP add-on | Locator-identifier separation (HIP, M-FARA, …) |
| Static end-user peering | **Personal Broadband (http://cfp.mit/edu), i.e., BB access based on user's choice, dependent on use, location, time & other context** |
| Licensed Spectrum and ISP mentality | **Open spectrum, cognitive radios -> virtually unlimited bandwidth** |
| Intra-domain, intra-technology access | Inter-domain & inter-technology in edge devices |
| Administrative IP domains | Regions based on geography, trust, administration … |
| Routers in the network | **Mobile devices acting as (ad-hoc) routers** |
| Management domains based on different technologies | **Knowledge plane as inherent part of Internet architecture** |
| Several competing (if at all) location techniques | Universal location support |
| Little network information available to edge device | Providing network-level context seen as differentiator and inherently supported |
| Scales to hundreds of millions | Scales to billions and more (Internet of Things) |
| Intra-domain QoS (at best) | **Full E2E (inter-provider) QoS** |
| ... | ... |

Note: Some of the Net2.0 functions can reach into NGI

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# Reasoning about the Content Scope
## Placing CFT along this Path of Evolution



Web1.0

Web2.0

Evolution path

CFT

?

NET1.0

NET2.0

Next Generation Internet?

1990

2000

2005

?

t

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# Content Scope
## General

Ensure Evolution
from Web 2.0
to NGI

New
Apps

Ensure Evolution
From Web2.0 to
Net2.0

Existing
Apps

Ensure Evolution
from Net2.0 to NGI

New
Nets

CFT

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# Content Scope
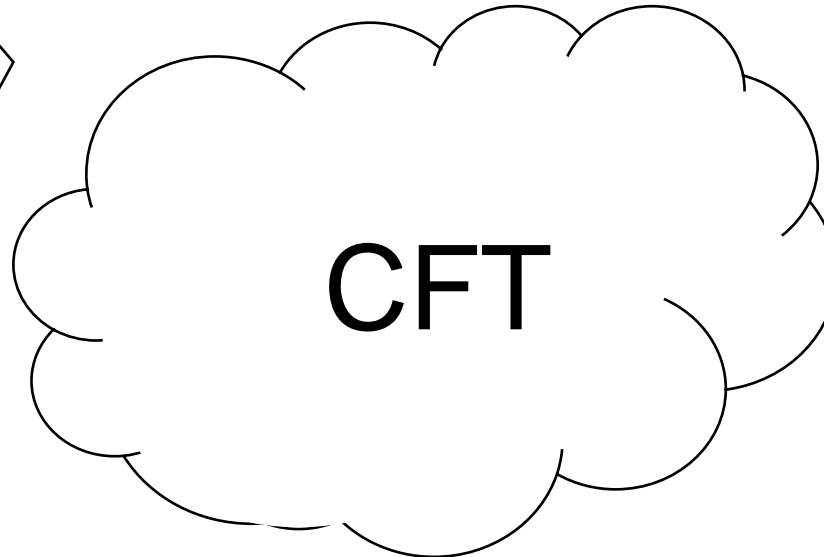## Possible Topics

Reality Mining, Voice Mesh,
ad-hoc communities,
many cool things

New
Apps

Reality Mining,
VidTorrent,
convergence scenarios

Existing
Apps

PBB, Knowledge Plane,
FARA, regions, WiMax,
Mesh, B3G…

New
Nets

CFT

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# Relation to NSF FIND

- Both are located in the area of networking (architecture) research

- BUT: Drivers are somewhat different

**CFT**: Evolution of the Internet from Web2.0 over Net2.0 further
  - Network architecture not in the primary scope

**NSF FIND**: Clean slate architecture design
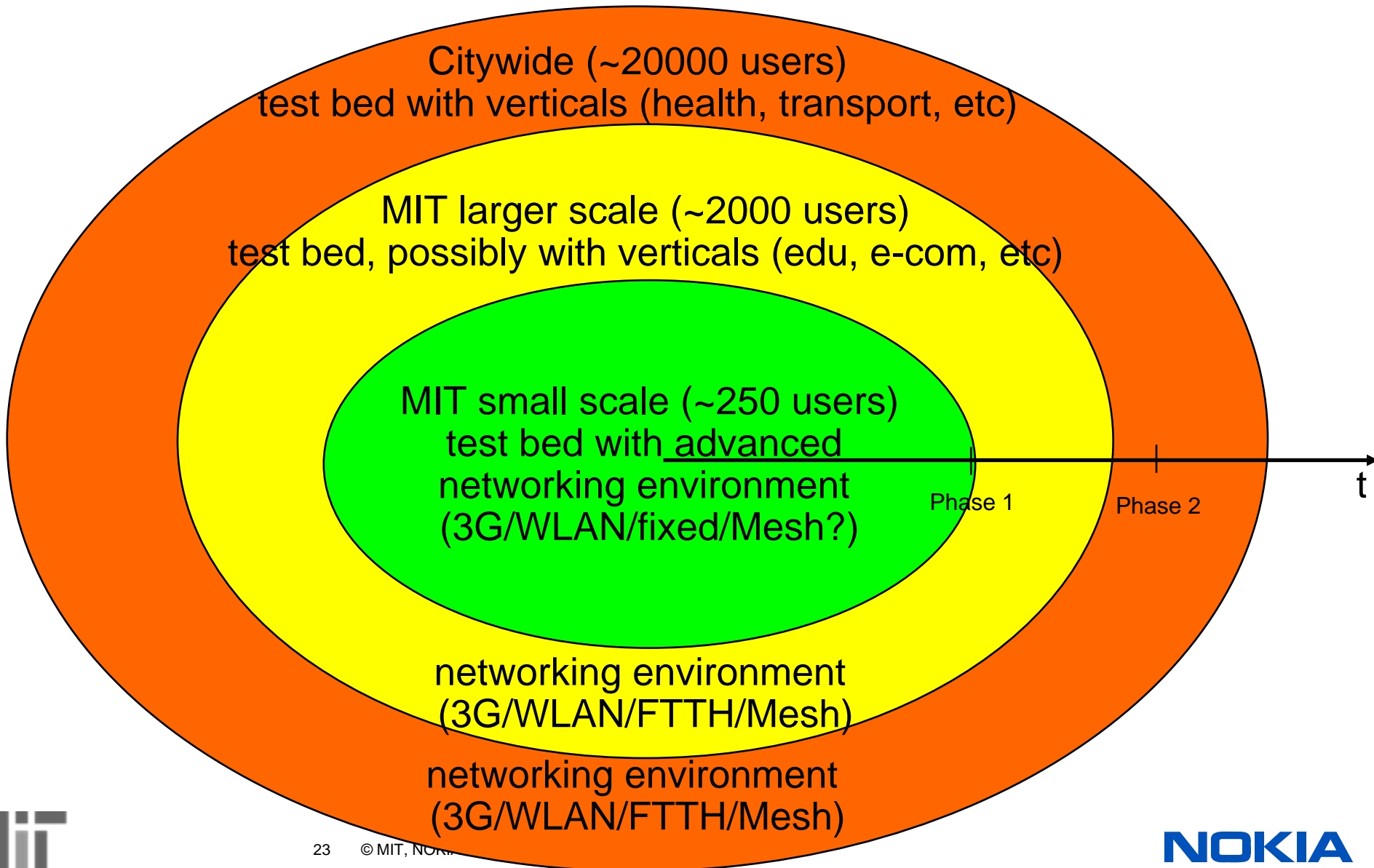  - Not an evolutionary view

However: relevant research topics are likely to overlap -> conduct NSF FIND research activities in CFT is an option to investigate

# HOW?

## Operation & Organization

# Operational Scope
## Proposed Build-Out

Citywide (~20000 users)
test bed with verticals (health, transport, etc)

MIT larger scale (~2000 users)
test bed, possibly with verticals (edu, e-com, etc)

MIT small scale (~250 users)
test bed with advanced
networking environment
(3G/WLAN/fixed/Mesh?)

Phase 1

Phase 2

t

networking environment
(3G/WLAN/FTTH/Mesh)

networking environment
(3G/WLAN/FTTH/Mesh)

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# Operational Scope
## Timeline

- **Phase 0: FY 2006**
  - Planning and promotion
  - Get commitment of all relevant parties (MIT, city, sponsors)

- **Phase 1: FY 2007-2008**
  - Phase 1 roll-out
  - Initial verticals: localized e-commerce, education, campus operations

- **Phase 2: Beyond 2008**
  - Continuation and extension of initial verticals towards home health, grade 7 -12 education, transport logistics,…
  - Phase 2 and 3 roll-out

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# Relation to NSF GENI

- GENI attempts to build a **large scale** (national & international) test bed for future Internet architecture research
  - Provides experimental environment for architecture efforts in, e.g., NSF FIND

- **Virtualizes** different architectural approaches within a single physical test bed
  - Based on clean slate assumptions of NSF FIND

**-> Differences to CFT: sheer scale and virtualization**

# Organization of CFT
## Division of Operation & Research
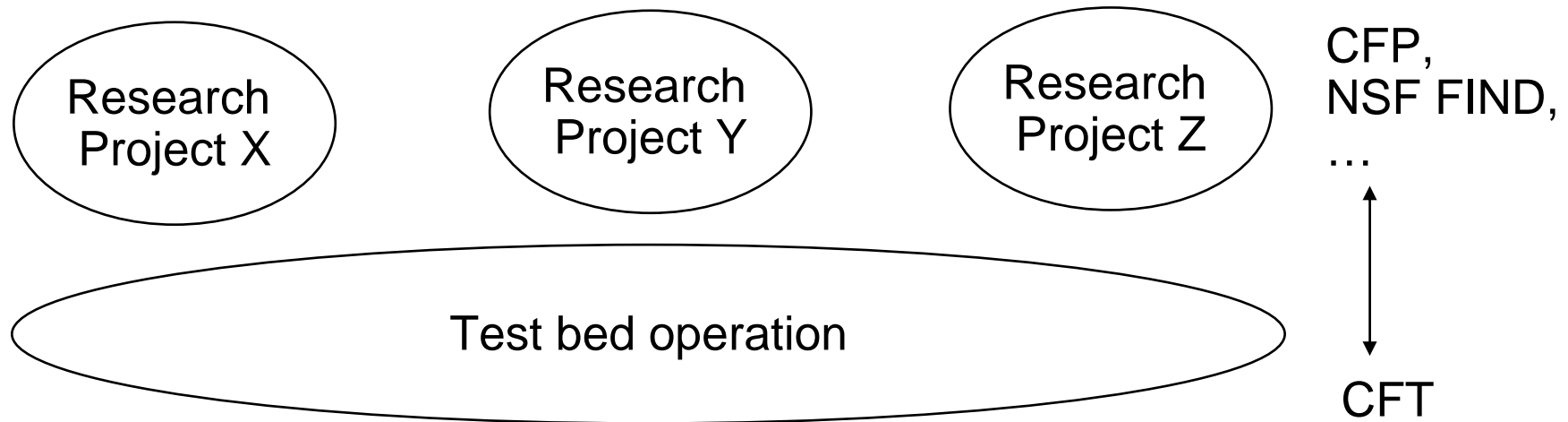


- Contract
  - Separate CFT sponsor agreement
    - To be clarified: relation to existing ones like CFP, TTT, CRN, others?

- Governance (jointly through MIT and sponsors)
  - Executive committee
    - Operational funding and coarse steering
  - Project committee
    - Decides on dedicated project inclusion within CFT (possibly including research funding commitment) using "participation template"

- IPR regime
  - Proposals?

# Participation Template
## Answer Questions About

- Goals and objectives for proof-of-concept stage
  - What does the stage hope to accomplish?
  - What types of applications/technologies should be tested?
  - How should the testing take place?
    - How should results/feedback be recorded/gathered?
  - What hardware/software solution will be needed?
    - What hardware will participants need?
    - What software will be needed?
      - Developed? Gathered?
  - Who will participate?
    - Students? Faculty? Staff?
  - What are the stage milestones?
  - What is the stage timeline?

# Participation Template
## Answer Questions About

- Operation:
  - Identify and develop device platform, e.g.,
    - Laptops with 802.11g connectivity (minimum)
    - Mobile software emulators (e.g., Series 60, Java MIDP)
    - Mobile applications to test
  - Organize test model
    - Develop instruction set/process
  - Small group pilot to test solution
  - Organize initial test application set
  - Organize test personnel hierarchy
    - Oversight group, test group leaders
  - Reach out to test community
    - Students? Faculty? Staff?
  - Distribute documentation/literature
  - Conduct initial meetings
  - Commence test with regular feedback sessions and channels of communication

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# Operational Plan
## Note Well

**CFT is not an easy undertaking, i.e., operational planning will be a major challenge!**

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# Next Steps

- Get initial interest from you!
  - Going forward?
  - Forget it?

If interested:

- 1H2006:
  - Meetings with key sponsors on equipment donations and staff commitment
  - Meeting with MIT administrative staff regarding MIT network usage
  - Project planning through "dry dock" exercise together with MIT Sloan Innovation Club (based on participation template)
    - Incorporate existing operational experience, e.g., Athena, PlanetLab

  -> **Milestone:** Detailed (number-based) project plan to be presented at CFP plenary June 2006

- 2H2006:
  - Gather concrete commitment and refine plans accordingly